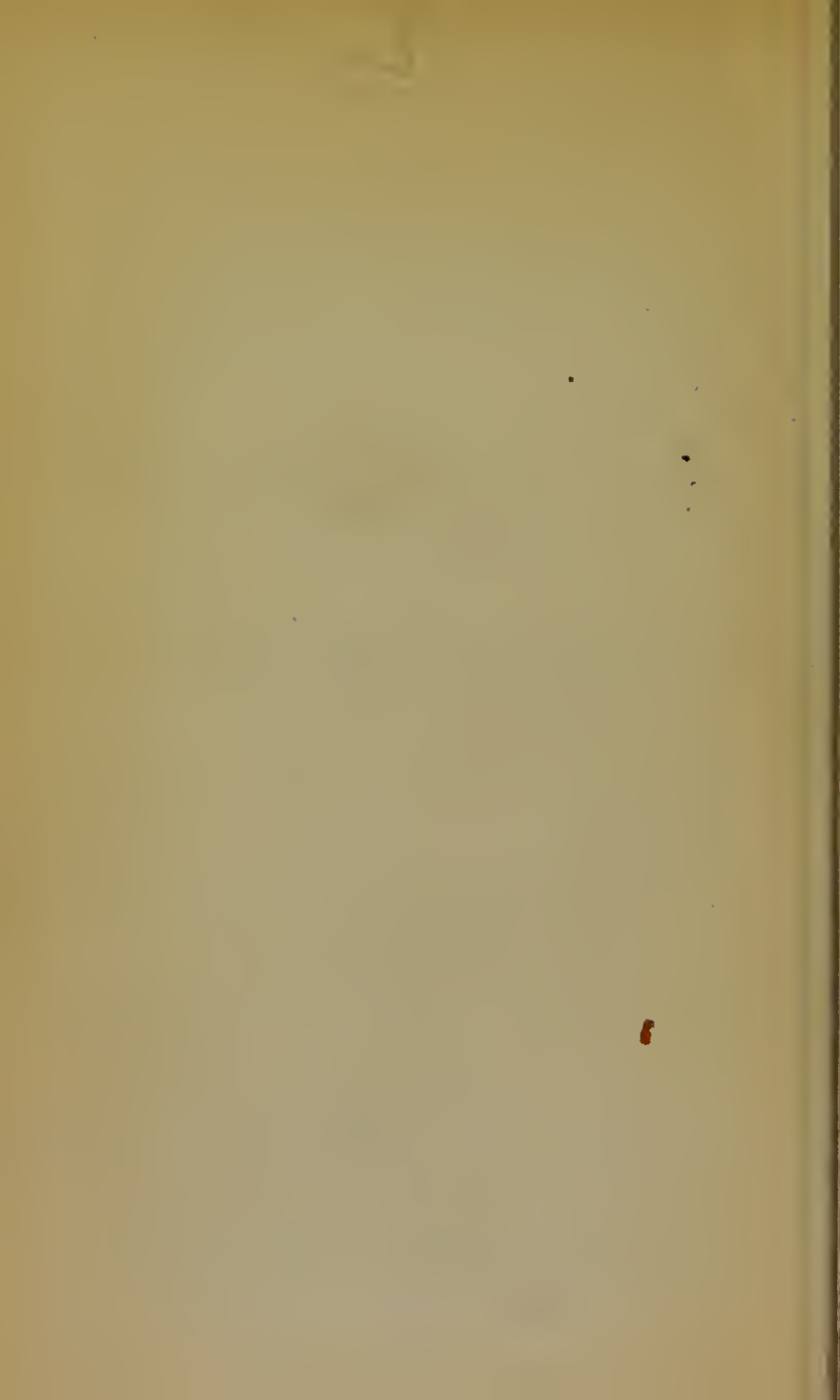


ON  
S Q U I N T I N G,  
ETC.



ON  
SQUINTING,  
PARALYTIC AFFECTIONS  
OF THE EYE,  
AND  
CERTAIN FORMS OF IMPAIRED VISION.

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## P R E F A C E.

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THERE are perhaps no deformities more common than strabismus, and there are few the pathology of which is less understood; this may be owing to the little importance attached to the affection, as it compromises neither the life nor the health of the individual. For this reason, though volumes have been written on the subject, and thousands of operations have been performed for its cure, the profession is still divided on many points essential to the right treatment of the deformity. One ophthalmologist asserts "that in almost every case of strabismus both eyes are equally implicated in the

abnormal position:" another holds a directly opposite opinion. The former maintains that it is immaterial which eye is operated on; the latter considers it essential to determine which is the really affected eye, and to operate on this only. There are others again who consider the deformity to depend upon an imperfection of vision, and say that if this be remedied no operation will be required, for the eye will right itself.

Such contrariety of opinion is not flattering to medical science, and proves how much yet remains to be elucidated.

Between three and four years ago I published some observations on Strabismus in the form of Lectures. In the present volume a different plan has been adopted. Cases are narrated substantially as they were recorded in my note-book at the time, and to these are appended such remarks as each seemed to suggest.

In the chapter on the pathology of strabismus, a tabular view of the origin of nearly 400 cases is given, and from an analysis of these cases and

of the phenomena of the affection some general conclusions are arrived at.

In the chapter devoted to the treatment of strabismus, I have confined myself entirely to the surgical mode of dealing with the deformity. I am well aware that incipient and slight cases of squint may sometimes be cured without operation, and that instances are not wanting, in which more confirmed distortions have been got rid of by persevering efforts on the part of the patient; but even when such efforts have been attended with success, the accompanying impairment of vision is not removed. Now, dividing the muscle by which the strabismus is produced, not only rectifies the malposition of the eye, but improves its vision, and on these grounds I hold the operation to be preferable to all other methods of treatment.

The remarks on paralytic affections of the muscles of the eye, are made chiefly with the object of elucidating the nature of the impaired vision which accompanies those affections, and

introductory to the observations on strabismic vision and other allied defects of sight in the following chapter. Lastly, some remarks on double vision have been added, explanatory of the phenomena manifested in some of the cases narrated in a previous part of the volume.

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# TABLE OF CONTENTS.

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## CHAPTER I.

	PAGE
On the different varieties of strabismus . . .	1
Section I. Illustrations of convergent strabismus .	6
„ II. Illustrations of divergent strabismus .	71
„ III. Illustration of downward strabismus .	89

## CHAPTER II.

On the pathology of strabismus . . .	92
--------------------------------------	----

## CHAPTER III.

On the treatment of strabismus . . .	130
--------------------------------------	-----

## CHAPTER IV.

	PAGE
On paralytic affections of the muscles of the eye	149

## CHAPTER V.

On certain forms of impaired vision	169
Section I. Muscular amblyopia, with distortion	170
„ II. Muscular amblyopia, without distortion	182
„ III. Asthenopia, or weakness of sight	198
„ IV. Diplopia, or double vision	206

## CHAPTER I.

### ON THE DIFFERENT VARIETIES OF STRABISMUS.

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WHENEVER the axes of the two eyes cannot be simultaneously directed to an object, the individual so affected is said to squint, and the squinting eye is that whose visual axis is at the time not directed to the object. This definition embraces the paralytic as well as the ordinary forms of strabismus; there is a peculiarity, however, about the latter—the distortion is not always confined to the same eye in the same individual; but will affect each eye by turns, being sometimes situated in one eye and sometimes in the other.

Strabismus is rarely met with in any other direction than inwards or outwards, combined sometimes with a slight inclination upwards or downwards. Of the inward and outward varieties of squint, the first is by far the more frequent,

and is met with under five forms. In the first form, which has been technically called *luseitas*, there is inversion of one eye, with a total inability to evert it, or even, in some cases, to bring it into the centre of the orbit.

In the second form, which is of rare occurrence, there is also, in the ordinary condition, inversion of one eye; but the affection differs from *luseitas*, inasmuch as the individual has the power of moving the eye in every direction, and can even bring the axis of the eye parallel to the other, which cannot be done in ordinary strabismus.

The third form is that which is generally recognised as single convergent strabismus. In this the squint always affects the same eye, and has no tendency to shift to the opposite one while both are open; but it differs from the last-described form, in the sound eye always becoming inverted when the squinting eye is straight. Thus, when the sound eye is closed or shaded, the squinting eye becomes straight, and the sound one inverted. On uncovering the sound eye, the two return to their former position.

The fourth form is the most frequent, and has

given rise to much confusion in the nomenclature of strabismus, some authors regarding these cases as examples of single, and others of double strabismus. The peculiarity consists in the tendency of the inversion to affect either eye alternately; one is always inverted, but it is not always the same eye. The alternation, too, takes place spontaneously, as it were, and thus differs from the variety last described.

In the fifth form of convergent strabismus both eyes converge unnaturally, and are never perfectly parallel; one may be more inverted than the other, and this greater degree of inversion may not always be confined to the same eye, so that even in this form there is a disposition of the squint to alternate; but it differs from the last in the fact, that one eye never becomes perfectly straight when the individual regards an object directly in front of him, but only less inverted than the other. This variety of strabismus all authors have agreed to call double.

Divergent strabismus is not only more rare than the convergent form; but it presents fewer varieties, and is less amenable to operative proceedings. It is seen not unfrequently as a

sequence, if not a consequence, of amaurosis, and is apt to follow a loss of vision, from whatever cause arising. I have met with three well-marked varieties of divergent squint, of which examples will be given hereafter. The first, or paralytic form of this affection, is better known as paralysis of the third pair of nerves, inasmuch as it is accompanied with paralysis of all the muscles supplied by the motor oculi nerve; consequently there is not merely eversion of the eyeball, but an inability to turn it inwards, upwards, or downwards; there is also a dropping of the upper lid (ptosis) and a dilated and immoveable pupil. The second form of divergent squint bears a resemblance, so far as the phenomena are concerned, to the second variety of convergent strabismus. There is eversion of one eye, but no mutual divergence; the organ can be brought into the centre of the orbit and retained there without causing eversion of the good eye, so long as volition is specially directed to this object, and no longer. Both eyes can also be made mutually to converge.

In the third, or most common form of divergent squint, there is not simply eversion, but

mutual divergenee; one eye, however, is usually more everted than the other, and there is nearly always a tendeney of the squint to alternate. Under no eircumstances can the two eyes be made mutually to eonverge. Strabismus in any other direction than inwards or outwards, combined sometimes with a slight inclination upwards or downwards, must be exceedingly rare. I have met with two cases in which the eyes were directed downwards to such extent that only a small part of the upper portion of each cornea was visible; I have subjoined one of them, which will be found in Section III, at the end of the cases illustrative of divergent strabismus.

## SECTION I.

### ILLUSTRATIONS OF CONVERGENT SQUINT.

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#### I. OF LUSCITAS, OR PARALYTIC CONVERGENT SQUINT.

THE deformity which goes by this name, consists of an immovable distortion of the eyeball in an outward or inward direction. It may be caused by disease or injury of the orbital museles or nerves, by burns about the eyelids, or by tumours within the orbit. The most common cause is undoubtedly the first, namely, disease of the orbital nerves or museles producing paralysis of the latter.

Unlike ordinary strabismus, the paralytic form is met with more frequently in the outward direction, and will be treated of under the head of Divergent Squint. I shall now proceed to give examples of paralytic convergent squint.



CASE 1.—*Paralysis of the sixth and ninth cerebral nerves of the left side, of syphilitic origin, producing inversion of the left eye and wasting of the left half of the tongue.*

James P—, æt. 30, a compositor, has convergent squint of the left eye, which he is unable to move outwards, even as far as to bring the cornea into a central position between the outer and inner angles of the eyelids; it can, however, be further inverted as well as moved upwards and downwards. The pupil of the eye has undergone no alteration of size, and moves as freely as that of the other. The patient complains of his sight being “a mass of confusion” when both eyes are open, and keeps a green shade over the left eye to obviate this inconvenience. With each eye singly he can see without confusion, though to the left objects appear brighter and smaller, and cannot be distinguished without being brought near to the face.

On putting out the tongue its point deviates to the left side, and what is remarkable, its two halves do not correspond, the left half being broad, flat, and thin, in fact atrophied, whilst

the right is plump, firm, and roundish. He complains of his food getting under his tongue and between the gums and cheek, on the left side, and he cannot remove it with the tongue, but is obliged to use his finger for that purpose. On the other side this inconvenience does not exist. Sensation and taste are not affected, nor is his speech. No other paralysis exists in any part.

These symptoms came on in July, 1846, accompanied with considerable pain in the head and back of the neck, for which he was treated by an ophthalmic surgeon, who applied repeated blisters, without affording him relief. At present (March 6th, 1847), the symptoms remain unabated. As this patient had been under my care in January of the preceding year, with a syphilitic affection of the bones of the legs, I thought it not improbable that the present symptoms might be due to a similar affection of the occipital bone, and that the abducent and lingual nerves of the left side had become implicated. I accordingly ordered him to be cupped to eight ounces at the back of the neck, and prescribed five grains of blue pill night and morning.

March 8th.—The pain is considerably relieved, but he complains of feeling weak. Pulse 72.

13th.—He is considerably better, more free from pain, and feels stronger. Bowels confined. He wishes to know if he may go to work next week. The pills were ordered to be continued, and a mild aperient mixture was prescribed to be taken occasionally when required.

20th.—He feels better than he has done for a long time, is stronger, and in better spirits; he has been at work the last few days, and does not find it fatigue him. He has no pain remaining, either in the neck or the head; he eats, drinks, and sleeps well. The eye and tongue, however, remain in the same state. He has continued taking the blue pill, which has produced no effect on the gums.

30th.—He was discharged cured as regards all his active symptoms, though the eye and tongue remain in the same state. He was anxious to know whether the squint could not be removed by an operation; but I dissuaded him from it, in the belief that it would before long disappear.

July 12th.—The patient again consulted me to-day on account of headache which he had ex-

perieneced for some time past on rising in the morning. I found him suffering from dyspepsia and constipation, which were shortly removed. The tongue had undergone no alteration, but the strabismus was less marked; he was able to move the eye slightly beyond the central position, and to maintain it in the centre of the orbit on regarding an object in front of him; but the sound eye then became a little inverted.

This patient again came under my care on the 21st of October, 1853, for another affection, which afforded me an opportunity of examining the condition of his eye and tongue. The former has recovered perfect freedom of motion in all directions, all confusion of vision has disappeared, and he considers the sight of that eye as good as the other; there is, however, a slight difference between them in this respect (and perhaps always was), he can easily read the "nonpareil" type with either eye and at arm's length; but at this distance it appears less clear to the left than it does to the right: on moving the book nearer to him the print is seen equally well with both eyes. On putting out the tongue its point is still directed to the patient's left side, but this deviation

seems to be partly owing to the features inclining to the right side (a congenital malformation, and not due to paralysis). The difference which formerly existed between the two sides of the tongue is now scarcely apparent, the left half having lost its flatness and become plump and round like the opposite.

Palsy of the muscles supplied by the motor oculi nerve is not an unfrequent occurrence, and is sometimes seen in connection with syphilitic disease affecting the bones of the base of the skull; but a similar condition of the abductor muscle of the eye and its nerve, from a like cause, is comparatively rare; while the simultaneous paralysis of the muscles of the tongue on the same side, invests this case with an unusual degree of interest. That the sixth and the ninth cerebral nerves were similarly and from a like cause affected, and that this cause was the syphilitic poison, I think no one who reads this case will doubt. The impairment of vision which was here observed always accompanies paralysis of any of the recti muscles, and is, I believe, due to the eye being thrown out of focus by the paralysis;

not that these museles are the sole and immediate agents in the foecal adjustment of the eye; but that they play an important subsidiary part in this function is, I think, eapable of demonstration. This ease is further valuable, on aceount of the refutation it affords to the opinion of those who maintain that the impaired sight, in paralysis of the motor oeuli nerve, is owing to the dilated pupil which aecompanies that affection—in the present ease the pupil was unaffected, yet still the sight was impaired.

CASE 2.—*Inversion of the right eye from paralysis of its external rectus muscle, the other muscles of that eye being unaffected.*

G. P—, æt. 38, was admitted into the Westminster Hospital, under my eare, on the 14th of April, 1857, for rheumatic iritis of the right eye, aecompanied with considerable intoleranee of light and lachrymation. A day or two after his admission, the eye was observed to be slightly inverted, and, on further examination, the patient was discovered to have lost all power of everting it beyond the ceentral axis; this was owing to para-

lysis of the external rectus and not to shortening of its antagonist, as the eye could be inverted to the natural extent, but not beyond. He was cupped to the temple, blistered behind the ears, and kept under slight mercurial action for some weeks. Under this treatment the iritis was completely cured; but the strabismus remained as on his admission. He was discharged on the 26th of May, when he stated that the strabismus had existed for some years. This patient was evidently labouring under some cerebral affection, independent of the inflammatory attack in the eye, as his manner and conduct during his stay in the hospital were scarcely those of a sane person: there was no evidence, however, of any other paralysis than of the external rectus of the right eye.

This case has been narrated, chiefly on account of the light it throws on the mechanism of strabismus, or rather the cause of the inversion of the sound eye. Thus, on several occasions, an inattentive observer might have thought the left eye of this patient the one affected, as it always became inverted when he endeavoured to straighten his bad eye, and the inversion being



still further increased whenever he looked to the right, while, at the same time, the paralysed eye remained in the centre of the orbit, he appeared for the time affected with bad convergent squint of the left eye. (See also case 1, p. 10.) These or analogous phenomena, which may always be observed when paralysis affects a single muscle of either eye, render it highly probable that the inversion of the good eye, in ordinary strabismus, is not due to any mere mal-association of the movements of the two eyes, or because they "start from different points," as one author has it; but simply to the effort, exerted by the abductor of the squinting eye, to execute a movement of which it is not capable; or to overcome its shortened or more powerful antagonist. Such an effort is necessarily, through the association between the two eyes, transferred to the adductor of the opposite or sound eye, and thus causes its inversion. This explanation of the participation of the sound eye in the deformity of its fellow, is also given by Mr. Walton in his work on Ophthalmic Surgery.



CASE 3.—*Inversion of one eye, with partial paralysis of the external rectus muscle, and probable shortening of the internal rectus.*

James W—, æt. 23, consulted me, January, 1841, for very bad convergent squint of the left eye, which is considerably more sunken than the other and with which he is totally blind; the other eye participates slightly in the convergence, but its vision is perfect. The cornea of both eyes are quite healthy, but there is a discoloration of the pupil of the left, seated apparently in the vitreous humour. He has very little power over the movements of this eye, and it cannot be everted beyond the central axis. The patient can give no account of the deformity, and has no recollection of ever having seen, or not squinted with the left eye.

January 11th.—I divided the internal rectus of the left eye with the best results, the cornea immediately afterwards occupying very nearly the central axis, and being symmetrical with that of the other. The power of everting the eye was not greater than before the operation.

20th.—Nearly all redness has disappeared, the

patient can turn the eye further outwards than before, and there is not more convergence than with the other eye.

This is a case which would now be treated by division of both internal recti muscles. Had this been done the result no doubt would have been perfect; but at the date of this operation surgeons had not ventured upon this hitherto untrodden ground. As it was, the result was far more satisfactory than if the eye had been made perfectly straight, by division of portions of the upper and lower recti, as was then so much the custom; for the squint would have been exchanged for a deformity as great, viz., a protruding eye.

CASE 4.—*Inversion of one eye, with complete paralysis of the external rectus muscle, and great shortening and thickening of the internal rectus, and of all the tissues in the inner periphery of the eyeball.*

Edward T. King, æt. 9, a healthy-looking, fresh-coloured boy, has had strongly marked inversion of the left eye from birth. The cornea

is partly buried in the inner canthus, and cannot be everted or even brought into the centre of the orbit; the conjunctiva at the inner part of the eye appears very much thickened, and more vascular than natural. During reverie, and when he tries to evert the left eye, the right becomes inverted; but under other circumstances it is straight. He cannot distinguish the largest type with the left eye; but with the help of a powerful lens he can read the word

## “Vision.”

With the right eye he is very near-sighted, and inclines the head to the left shoulder when reading.

*History.*—The boy's parents state that at birth both eyes were strongly turned inwards; but as he grew and began to use his eyes, the right became more straight and has so continued; but the left remained fixed in the corner and has never occupied any other position.

On the 3d of April, 1856, I operated on this boy. Though he was under the influence of chloroform, it was found impossible to draw the eye outwards, even as far as to bring the cornea

midway between the two canthi. The knife was with some difficulty passed beneath the internal rectus and the muscle divided; it was exceedingly tough, and its division failed to remove the deformity. The conjunctiva and fasciæ beneath were therefore freely divided, and presented scarcely less resistance than the muscle. When this was done, the cornea was pulled into a central position and so remained, the external rectus having lost all power of everting the eye.

4th.—The eye still occupies a central position, and the father of the child is much pleased with the result. The external rectus has no more power over the eye than it had yesterday. He can now read without difficulty the type he could only decipher yesterday by help of a powerful lens, and the vision of the right eye has much improved. This patient had been under the care of an ophthalmic surgeon at a large hospital, who had declined to operate.

Oct. 24th, 1857.—I saw this patient to-day. The eye remains straight; but owing to the width between the lids at the inner canthus, and the retraction of the caruncle, it looks rather fuller than the other, and the boy's mother considers it

the finer eye of the two. The paralysis remains as it was immediately after the operation ; that is, the boy can roll the eye upwards and downwards, but not inwards or outwards. The sight also of the eye has undergone no further improvement ; he can read large type, such as this,

## “Vision,”

but no type smaller. The sight of the right eye is perfect ; he can read the “minion” type with facility, and distinguish with ease both near and distant objects. The left eye never confuses the vision of the other, but, on the contrary, assists it, so that he sees better with both eyes open than with the left eye closed.

The occurrence of strabismus as a congenital defect has been doubted by some, but on what grounds I have been unable to learn ; intra-uterine disease we know is not uncommon, congenital varus is exceedingly common. The parents of this child are both very intelligent persons, and I see no reason for doubting the truth of their statement. For what reason an operation

was declined by the surgeon who attended this case before it was brought to me, I cannot say: waiting could not possibly have improved the position of the eye, or increased the chance of success from an operation, while the immediate improvement which followed this proceeding would, in all probability, have been equally attained at an earlier period. The improvement of vision in *both* eyes, consequent on an operation on *one*, is a fact of great physiological interest, to which attention will be directed in the chapter on strabismic vision. Altogether this case is one of considerable interest, and well calculated to demonstrate the value of tenotomy not only in distortions but also in certain defects of sight.

## II. OF THE SECOND FORM OF CONVERGENT SQUINT.

Examples of this are rare; but I have met with two well-marked cases, which will now be given. The peculiarity, it will be remembered, consists in the power which the patient possesses of maintaining the eyes parallel by a voluntary

effort; but as soon as this effort is discontinued one eye becomes inverted.

CASE 5.—Miss W—, æt. 18, was brought to me by her father, to be operated on for convergent strabismus of the right eye. When she first entered my consulting-room, the cornea of this eye was almost buried in the inner angle; but on placing her opposite to me it had righted itself, and the eyes continued parallel during the whole time I was conversing with her. On holding up my hand, however, about three yards in front of her, and asking the number of fingers I held up, the affected eye immediately became inverted. This experiment was repeated several times, the objects exhibited only being varied, and always with the same result. So long as she abstained from scrutiny, the eyes were parallel; but the moment she made an effort to distinguish objects, the right eye turned inwards. The patient then informed me, that when her eyes were straight her vision was very indistinct, even with the good eye; but as soon as the other became inverted, the sight was restored. On looking to her left side, the eyes lose their



parallelism, the right being unnaturally inverted. On looking to her right side they maintain their parallelism, the left not being abnormally inverted; but she remarked, when I told her to look to the right, that she could not see so far in that direction as in the other.

The history of this deformity dated from four years of age, but the cause was unknown.

On the 30th of October, 1856, I operated on the right eye of this patient subconjunctivally, while she was under the influence of chloroform, but I fear a small portion of the muscle was left undivided, as, ten days after the operation, she was able to invert the eye nearly to the same extent as before, and it continued to roll inwards whenever she scrutinized. I therefore, on the 14th of November, divided the inner rectus of the left eye, and by the old method, to make sure of its perfect division. The second operation was so far successful, that *no effort* was now required to maintain the parallelism of the eyes; and even on scrutiny the inversion of the right eye, which was before considerable, was now very slight, and took place without the patient being conscious of it, as she was before the last operation.



If we except the inversion which results from simple paralysis of the external rectus muscle, this case is the nearest approach to one of pure, uncomplicated, single convergent strabismus that I have yet met with. Its rarity may be inferred from the following remarks of Mackenzie: "Authors speak of single and double strabismus. To constitute a case of single strabismus, the distortion, whether convergent or divergent, should always appear in the same eye, and not affect the good eye, even on shading it with the hand; while the squinting eye is directed straight towards objects. Such a case rarely, if ever, occurs." I stated that this was the nearest approach to single strabismus, as defined by Elliot and Mackenzie, that I have met with; yet even in this case it cannot be said that the good eye was wholly unimplicated, for the operation on the faulty eye having only partially succeeded, a second, undertaken on the good eye, was followed by marked improvement.

The result of these two operations completely refutes the dogma laid down by a recent writer, viz., that it is immaterial which eye is operated on; and the equally incorrect statement of

another, that "an operation on the sound eye may or may not be followed by eversion, but can in no way affect the one that squints." (See also Case 28.)

CASE 6.—Mr. H—, æt. 41, pale, and slightly marked with smallpox, had a slight attack of hemiplegia of the left side about nineteen years ago, from which he perfectly recovered. Four or five years ago, his friends remarked that he occasionally squinted with the left eye, and shortly afterwards he himself became conscious that on looking at distant objects the eye always became inverted, and so it has continued to be, under like circumstances, ever since. In reverie, inversion of this eye also takes place. As with Cases 5 and 21, so likewise with this patient, if he maintains the eyes parallel, vision is very indistinct, and to render it clear, the left eye must be inverted. He sees rather better with each eye singly than with both open, though double vision is never observed. Both eyes are myopic, and he uses deep concave spectacles; but what is remarkable, the vision of the left, or squinting eye, is better than the other, and he can read with it

"nonpareil" type, while with the right he cannot distinguish a type less than "bourgeois." The power of eversion of both eyes is somewhat limited, and that of the left is rather less than the right. The inverting power is not exaggerated.

Not less remarkable than the power of maintaining the parallelism of the eyes was the condition of vision in this case, which was better in the squinting eye than in the sound one; but as strabismic vision will form the subject of separate consideration in a subsequent part of this work, I shall defer my remarks on this case till then.

### III. OF THE THIRD FORM OF CONVERGENT SQUINT.

The following are examples of the single convergent strabismus of most authors, though by Elliot and Maekenzie they would be regarded as double. They differ from Cases 5 and 6 in the greater association in the movements of the eyes, the straight position of one always necessitating the inversion of the other.

CASE 7.—John H—, æt. 11, has bad con-

vergent strabismus of the right eye; the cornea is nearly half hidden in the inner canthus, and the squint has no tendency to alternate, but always remains in the same eye. On closing the good eye, the squinting one becomes straight, and can be moved freely in all directions, and nearly as far outwards as the left; but whenever the squinting eye is straight, the other is inverted. Vision is so imperfect that the boy cannot make out the largest type in the title-page of Dr. Budd's work on the 'Stomach.'

The deformity has existed since he was two years of age, and it came on without any obvious cause.

On the 24th of May, 1856, I divided, subconjunctivally, the internal rectus of the affected eye, in the presence of Messrs. Crompton, Beever, and Hutton, of Manchester. The operation was done with the knife I have recommended, and from above: the tendon of the muscle was very thick, and yielded with an audible crack. The morning after the operation, the patient could read with this eye the print he could not decipher before. A slight degree of inversion was still visible, which subsequently disappeared, and on the 2d of August, Mr. Crompton writes me

word that "H—'s eyes are looking remarkably well, and I consider the operation has been remarkably successful. So completely has every trace of the incision vanished, that I was puzzled to know which eye had been operated on."

CASE 8.—Mrs. H—, æt. 39, has had convergent strabismus of the right eye since eleven years of age, at which period she suffered much from frequent headaches, accompanied with sickness, and she distinctly recollects that in one of these attacks she was very giddy. The giddiness lasted for two days, after which the eye became inverted. She has a family of four children, none of whom are similarly affected. The inversion of the eye is very considerable; none of the sclerotic internal to the cornea being visible. It is always confined to the right eye, and has no tendency to affect the other, which does not converge even when the eyes are at rest, but only when it is closed or shaded. Notwithstanding the high degree and constancy of the inversion of the right eye, it can be everted to nearly the same extent as the other; the pupil is of the same size as that of the sound eye, and acts freely.

Vision of the left eye is good. She can read with it the "nonpareil" type; with the right she cannot make out a single letter of the large type,

### "DIFFERENT SIZES."

On holding the book containing the above words to the right of the eye, they can be seen somewhat better, and some of the letters distinguished. The squinting eye interferes a little with the vision of the sound one, so that the patient sees better when the former is closed. On asking her if she ever saw objects double, she replied in the affirmative, and stated that the image of one was very faint and indistinct, "a sort of shadow of the other."

This case is instructive in two or three points of view. In the first place it would seem to show that hereditary tendency in the production of this deformity cannot be very strong, as this person had four children, all free from squint; nor should much stress be laid on imitation, as a remote cause, for the same reason. In the second place, the impossibility of maintaining the squinting eye straight unless the other was in-

verted is well illustrated, and lastly, it would appear that the most sensitive part of the retina corresponded, in this particular case, with the point on which the direct rays of light fell, when in its abnormal position.

CASE 9.—E. T—, æt. 13, has a “east” of the left eye, upwards and inwards. She can move the eye outwards to a somewhat less extent than the other, but inwards to a greater extent. The pupil and cornea are alike in both eyes. She cannot make out the largest print with the left eye. Though the vision of the right is good, on using the eyes for long together, vision becomes indistinct and misty, and she sees double. The east was first observed when she was a year old. On the 7th of September, 1840, I divided the internal rectus of the eye affected with the greatest facility, and with the immediate and complete removal of the deformity. The lids were brought together with a piece of sticking-plaster, and on its removal, on the 10th, the eye continued perfectly straight, and she was able to move it slightly inwards. Her vision is so improved that she can read with facility the



“English” type, and with some difficulty the “pica.” The eye was directed to be left uncovered, and the sound one to be bound up for two hours daily, with the object of improving the vision of the previously distorted eye.

October 6th.—Though my directions with regard to binding up the sound eye have been strictly attended to, the vision of the left is not more perfect than it was immediately after the operation, so that the pica type is still distinguished with difficulty, and to read with that eye the book is held at some distance from her, and very much to her left.

December 15th.—I again saw this patient; the eye does not look so gainly now as it did a month after the operation, owing to the shrinking of the earuncle having given to the eye an appearance of greater fulness than the other; the sight also has undergone no improvement. The affected eye cannot be inverted as far as the other, still no double images are seen when she regards an object much to her right.

In this case, as well as in the last, it will be observed that the most sensitive part of the



retina of the squinting eye, corresponded with the point on which the direct rays of light would fall while it was distorted; hence some writers have imagined, that this increased functional activity of that part of the retina, was due to its being more stimulated; and they have gone so far as to affirm, that when the eye is rectified by an operation, the sensibility of this abnormal point of most acute sensation gradually diminishes, while the normal point regains its power. These views are sufficiently refuted, first by the fact, that this transposition, as it has been erroneously termed, of the most acutely seeing point of the retina to some other point, is very rare, and altogether exceptional; and secondly, by the fact, that when such a condition of things is met with, the rectification of the position of the eye does not alter them. In the case just related, it will be observed that although the squinting eye had been completely rectified by the operation, and although the sound one had been bound up for two hours daily, for three months, still the abnormal point of most acute sensation, had neither been transferred to any other point of the retina; nor had the visual

power of the eye increased. A more probable hypothesis is, that this point of most acute sensation is simply a part of the retina that is less diseased than the rest of that membrane, and possibly the squint may be the result of a reflex act to bring this part into the direct axis of vision. See Case 36, among the examples of divergent strabismus.

CASE 10.—Mrs. B—, æt. 37, has had bad convergent strabismus of the left eye from infancy, and has heard her mother say it was from cutting the teeth. She has four children, none of whom are affected with the deformity. The right eye appears unaffected, and does not become inverted even in reverie, only, on shading it, when the other becomes straight. The power of inverting the sound eye is greater than natural, but with the other it is much more so, and the outer and inner margins of the cornea can be made to look forwards and backwards. On the contrary, the power of everting this eye is less than natural, and the cornea can be barely brought beyond the centre of the orbit. Vision of the left or squinting eye is always misty, and

the mistiness, though lessened, is not removed, with a convex lens; the patient can, however, distinguish with difficulty, and one by one, the letters in

### “DIFFERENT SIZES,”

whereas with the other eye, the “nonpareil” type can be read fluently. Objects are best seen with the distorted eye when held exactly opposite, and at about the ordinary reading distance; when held to the left of the eye they cease to be distinguished. She never sees double, nor does the bad eye at all interfere with the vision of the other.

The last four cases are well-marked examples of the single convergent strabismus of most authors, the good eye participating but slightly in the inversion of its fellow, and that only under particular circumstances. The following case would be regarded by many as an example of double strabismus, so much did the left eye participate in the inversion of the right; yet that it was really single, the adductor muscle of one eye only being structurally affected, the result of the operation is sufficient proof.

CASE 11.—Ann R—, æt. 19, has bad convergent strabismus, in which both eyes participate, though the right is more inverted than the left. On applying the test recommended by Mr. Walton to ascertain which was really the squinting eye, it failed, inasmuch as when an object was regarded with one eye, the other being closed, it continued to regard it when the opposite eye was opened, and this was the case with both eyes; so that, in point of fact, this so-called test would go to show that the girl did not squint at all. Whichever eye was closed, however, it was always found inverted on raising its lid.

As the girl was unable to read, her state of vision could not well be tested, but she declared that she saw well with both eyes.

The right eye, being most inverted, was operated on, January 12th, 1854, by the old method, with a complete removal of the squint from both eyes.

May, 1856.—This patient was again seen, the result of the operation remains satisfactory, and the girl is well pleased with the improvement. There is a little vacuity observable in the inner canthus, and the plica semilunaris and

earunele have somewhat reeeded, but in a less degree than is frequently observed after this operation.

The two following eases, one only of which was operated on, are given with the view of pointing out a defeet which sometimes exists in conneetion with strabismus, and is apt to be attributed to the operation for the removal of that deformity. I allude to a greater width between the eyellds at the inner angle of the strabismie eye. Where this exists it gives to the eye an appearance of greater fulness, which was unobserved while in its inverted position; but the greater deformity being removed by operation, the lesser one becomes more evident.

CASE 12.—Fanny H—, æt. 6, a half-idiotie-looking ehild, has bad eonvergent strabismus of the left eye, in which the other partieipates. It ean be moved freely in all direetions, execept outwards, being somewhat limited in this direetion and inezeased in the opposite. There is no apparent differenee in the bulk of the two eyes, although when the lids are elosed the right or

good eye appears slightly more prominent than the other ; there is, however, a decided difference in the space between the lids internal to the cornea, that of the left or squinting eye being greater than that of the other. The child not being able to read, and withal deficient in intelligence, the relative condition of the sight of the two eyes could not be determined. The mother of the child is affected with an external strabismus.

CASE 13.—Georgiana L—, æt. 11, has convergent strabismus of the right eye, which is less prominent than the other ; but the cornea of each is alike, and the pupils are clear and healthy in their movements. The patient can move the eye freely in all directions, though to a less extent outwards and to a greater extent inwards than the sound eye. The vision of the squinting eye is less perfect than the other, so that she can only by a great effort, and holding the book near to the face, make out a word or two of the “brevier” type ; but with a convex glass can read the “non-pareil.” The vision of the bad eye does not interfere with that of the other, and the patient never sees

double. The mother of this girl first perceived the strabismus when the child was about three years old, but she cannot tell the cause, as the child was healthy and never suffered from ophthalmia.

On the 14th of December, 1840, I divided the tendon of the adductor muscle of the right eye, it was very tough. The eye immediately became straight, slightly more prominent, and its sight improved, so that she could read the "nonpareil" type with a little difficulty, but the power of turning in the eye was destroyed.

31st.—Some redness still remains in the eye, and its power of inversion has not been recovered, so that when she looks sideways towards the sound eye she sees double: the improvement of vision continues, though it is still not so good as with the other eye.

Feb. 1st.—The eye appears somewhat more prominent than the other, which is evidently due, in great measure, to the lids being wider apart in this eye than in the other in the space between the cornea and the inner canthus.

December 11th, 1853. I accidentally heard of this patient, through her cousin, Louisa L—, and requested her to call on me, that I might



examine the sight. I found that it had gone back since the operation, thirteen years ago; and she could now only make out the "small piea" with the formerly squinting eye, and with some effort, in a good light, a word or two of the "brevier." Though the power of inversion had not been recovered, she stated that she never, under any circumstances, saw double, nor did the vision of the bad eye interfere at all with that of the good; on the contrary, she considered that "it assisted the other," though she "could not get her living by it," as a map-painter.

The two following cases of strabismus are given on account of the light they throw on the mode of origin of this deformity. The first is a well-marked case of strabismus of nervous origin; the second of inflammatory.

CASE 14.—Master F—, æt. 4, a healthy looking intelligent child, has had convergent strabismus of the left eye of twelve months' duration. His mother says that the squint did not attain its present degree all at once, but was at first slight, and has been gradually getting worse up to the



present time. It happened in this wise. While playing, one Saturday, the child fell down, and struck the right side of his head against the fender; it was slightly bruised, but he was not much hurt, and continued his play as before. On the Monday following, he was observed to squint with the left eye, and to be affected with an involuntary twitching of the muscles of the left side of the face, which continued for three months. Four days after the occurrence of the above symptoms, he was taken to an ophthalmic surgeon, and continued under his care for six weeks without benefit; the treatment consisting in blistering and purging. He was afterwards placed under the care of another oculist, who considered the symptoms arose from worms, and prescribed powders and steel medicine, which were persevered in for three months without perceptible benefit. At present (December, 1856,) the left eye is much inverted, but the right is nearly straight, and there is no tendency of the squint to alternate. The inverting power of both eyes is unnatural; the left so as to conceal two thirds of the cornea, the right one half; the former can be everted to within one line of the

outer angle of the eyelids, the latter to a natural extent. The vision is at present but little impaired; the child can read the "nonpareil" type with each eye, though he has some difficulty in doing so with the left; in reading a larger type than this, no difference was observed in the facility with which each eye deciphered it. The division of the adductor muscle of the eye affected removed the deformity, and immediately restored the vision.

This case illustrates well, the origin and progress of strabismus of nervous origin, the inutility of all the ordinary medicaments, and the speedy and complete removal of the deformity by operation.

CASE 15.—Emily C—, æt.  $3\frac{1}{2}$ , was brought to me, on the 5th of April, 1853, with a serofulous ulcer on the left leg, and another on the arm: both shortly healed under the treatment adopted, when some impetiginous pustules made their appearance on the scalp, and at the same time the left eyelid became affected with a phlegmonous inflammation, which completely closed

the eye. This was on the 22d of April, and previous to this date both eyes were perfectly healthy and free from distortion. Exaetly one month after this the lid had nearly reeovered its usual healthy appearanee, the pustules had disappeared from the scalp, and the general health had much improved ; but she now squinted badly with the eye, the lid of which had been inflamed, and a twelvemonth after this date, the eye continued permanently distorted. I directed the mother to bind up the sound eye for a week, and then bring the ehild to me, when she hesitated, and seemed to demur to my direetions. On asking the reason of her hesitation, she told me that she had of her own aeoord bound up the squinting eye when its lid was inflamed, and that she considered the squint had been brought on by her having done so, for she observed that while the bandage was over the inflamed eye, the ehild was always trying to make use of that eye by looking inwards, and out of the way of the bandage.

The two following eases, though unpromising at the time of the operation, and a few days afterwards, eventually turned out remarkably well,

and are two of the best examples I have ever seen of the success of the old method of operating for strabismus.

CASE 16.—Mr. M— consulted me, on the 29th of November, 1854, for convergent strabismus of the left eye. It appeared slightly smaller than the other, and could not be everted to the same extent, or nearer than two lines of the outer canthus. Its vision was less perfect than that of the right, and “brevier” type could with difficulty be read.

Owing to the eye affected being less prominent than the other, I divided the internal rectus, together with the conjunctiva, after the old method; but was somewhat annoyed at the amount of retraction of the conjunctiva which took place on division of the muscle, and by which the sclerotic was left exposed.

December 4th.—The eye operated on was slightly everted and very vascular, the patient had lost all power of turning it inwards, and complained of confusion of vision.

11th.—The eye, though still vascular, had much improved in appearance, and the eversion

had completely disappeared ; he could invert it slightly, and the confusion of vision had vanished.

18th.—The eye remained in a satisfactory condition, but was still somewhat vascular, and a small granulation had sprung up internal to the cornea, which required touching two or three times with nitrate of silver. The case shortly turned out very well, and quite beyond my expectations ; not the slightest squint remained in either eye, and the patient had full power over the movements of the one operated on. He was well satisfied with the result.

CASE 17.—Benjamin S—, æt. 17, affected with chronic conjunctivitis of both eyes, has a slight nebula on the cornea of the left eye, which is inverted and a little inclined upwards. The eye appears somewhat smaller than the right ; the pupil is natural, and acts readily ; the movements of this eye are free in all directions, though it cannot be everted as much as the other. Vision is very imperfect in the squinting eye ; he is unable to read, and cannot recognise a friend with this eye. He can see a variegated coloured ruler that is held before him, and perceive that

the colours are different, although he cannot distinguish what they are. Every object, to be perceived, must be held very near to the eye; if held at more than two feet from his face it cannot be seen. The cause of the deformity he ascribes to a piece of lime having got into the eye when about six years old; this set up violent inflammation, which lasted for several weeks, and he has been subject to inflammation in that eye, whenever he gets cold, ever since; it must, however, be mentioned, that the boy's father is affected with strabismus.

On the 6th of October, 1841, I divided the internal rectus of the left eye with some difficulty, owing to the resistance and struggles of the patient. After its division, the eye became somewhat fuller, and the cornea occupied a central position; the power of adduction was lessened, but not destroyed. Before the operation, half of the cornea was buried in the inner angle; now he could conceal no portion of it.

November 25th.—Not the slightest degree of convergence is perceptible in either eye, and the vision of the one operated on is much improved; in fact, the case has turned out as satisfactorily

as could be desired, and the boy is highly pleased with the result.

September 15th, 1857.—This patient met me accidentally in a shop to-day, and at once recognised me. He expressed himself as very grateful for what I had done for him sixteen years before. The eye has continued straight, and he had forgotten which it was, but imagined it was the right.

CASE 18.—George F—, æt. 16, has convergent strabismus of the right eye, in which the left slightly participates. He can move the eye freely in all directions, but to a less extent outwards, and a greater extent inwards than natural. The vision of the eye affected is not so good as that of the other, the patient being unable to read a type less than the "brevier" without a convex lens, though with the left eye the smallest type is easily read. The lad has no knowledge of the cause of the deformity, but he says that his mother, sister, and brother are similarly affected. On the 24th of February, 1855, I divided the adductor muscle of the right eye subconjunctivally with my strabismus-knife. Not a drop of



blood escaped, though some was effused beneath the conjunctiva.

26th.—The eye is a little bloodshot, but perfectly straight; it can be inverted as far as the inner canthus, and can be everted to the natural extent. The vision was not tested.

The last time I saw this patient, in July, 1856, there was no indication of the eye having been operated on; no cicatrix was visible; there was no hollow at the inner angle of the eye, as so frequently results from the old method of operating; the *plica semilunaris* and *caruncle* were as perfect and visible as those of the opposite eye; the patient retained the full power of inversion, and both eyes were parallel in all their movements.

CASE 19.—On the 27th of September, 1856, I was requested by Mr. Pretty, of Camden Town, to operate on a little girl, eight years of age, who had had convergent strabismus of the right eye since four years of age. The eye was more prominent than its fellow, its inverting power was exaggerated, and its vision impaired, though the child had never suffered from ophthal-



mia. She could with great difficulty read a few words of the "brevier" type; the sight of the left eye was good. The operation was performed subconjunctivally with complete success; and three days afterwards, the sight of the eye being again examined, she could read the "nonpareil" type with great facility.

This and the preceding cases illustrate the advantages of the subconjunctival mode of dividing the adductor muscle, which is more especially to be preferred whenever the squinting eye is fuller than the other.

#### IV. OF THE FOURTH FORM OF CONVERGENT SQUINT.

This form, it will be remembered, is chiefly remarkable for the tendency of the deformity to shift from one eye to the other, which has given rise to the term "Alternating" being applied to it. This peculiarity has been supposed by Maekenzie and others to depend on the equality of vision of the two eyes, or rather on the slight

difference of their visual powers; or, as I have expressed the same fact elsewhere: "The less the difference in the visual power of the two eyes, the greater the tendency of the squint to alternate; and conversely, the greater the difference in the visual power of each eye, the less the tendency to shift." Theoretically, one would say, this ought to be so, and as a general rule it may be; but exceptions to it are certainly far from uncommon, as Cases 21 and 22 will illustrate. In both of these, the disparity of vision was very considerable, yet the tendency of the squint to alternate was strongly marked. Exceptions to this rule are however met with, not only in the direction of great disparity of the visual power of the two eyes, but in the opposite, as will be seen on reference to Case 14, where the difference in the visual power of the eyes was slight, and the tendency of the squint to alternate, equally so.

It is the class of cases we are now considering, which has occasioned so much difficulty in determining the eye most affected, that even an ophthalmic surgeon of repute has acknowledged that he has "sometimes been obliged to

wait until a second visit to detect the faulty eye."

In the 'Medical Times and Gazette' of June 28th, 1856, I pointed out that the condition of vision of squinters furnished us with a ready and certain test whereby we might at all times obtain the information we sought for; and I stated further, that in those very few cases in which the sight of the two eyes was alike, it was immaterial which eye was operated on. "The visual power is the only test that can be depended on, and the rule of practice would appear to be this: in true alternating squint, where the power of the two eyes is alike, it is immaterial which eye is operated on; while in the false, and by far the most frequent variety of alternating squint, that eye should be selected for operation, the visual power of which is inferior."

Other tests have been recommended, but none are so generally applicable as this. Mr. Walton, for instance, recommends the following: "I place the patient," he says, "in front of me, at a distance of two or three yards, and direct him to cover one eye—say the left—and look at me with the other, keeping the head straight: the

right eye will be in the centre of the orbit. I then direct him to uncover the left. Now, if the right, which has not been closed, is normal, it will keep its central position, while the left eye is turned inwards; but if it be deformed, it will turn in, while the left will become straight. The experiment should be reversed."

No doubt this test frequently succeeds, as in like manner do those proposed by Lucas, Mackenzie, and others; but unfortunately they fail in just the class of cases in which they are most needed, those, namely, in which the difference between the visual power of the two eyes is but slight. (See Cases 11, 23, 24.)

CASE 20.—Mr. W—, æt. 21, has squinted from two years of age, and is not aware of any cause to which the deformity can be attributed, unless it be hereditary tendency, to which he ascribes it, several of his relatives on his mother's side being similarly affected, and some of them in a higher degree than himself. It has existed in the family for several generations.

Both eyes are more convergent than natural, but equally prominent; the pupils also are alike.

On regarding objects in front of him, while unobserved, one eye is always inverted, though not always the same eye, as he uses both indifferently, the vision of each being perfect; but if conscious that he is observed, he can prevent the inversion of either eye singly, and maintain them both very nearly parallel, that is to say, the convergence is so slight as to be almost unobservable, and affects the two eyes equally. On looking sideways, one eye is too much inverted, and the other too little everted. Notwithstanding this want of parallelism, he positively declares that he sees an object, such as the finger held up to the side of him, with both eyes at a time; and sees it *single*, and this is the case whether the object be held to his right or left side. He never, under any circumstances, sees double. The power of everting both eyes is somewhat imperfect, he being unable to approximate the cornea nearer than two lines of the outer canthus.

This case throws much light on certain disputed points concerning binocular vision. It is well known that for single vision with both eyes, it is generally necessary that the image of an

object gazed at should fall on certain corresponding parts of the two retinae; and if this condition be not fulfilled, double vision will result. Hence, certain physiologists have contended that this identity of function of these parts of the two retinae is an inherent property of that membrane; while others affirm that objects are seen single, simply because these parts of the retinae are accustomed to receive similar impressions. The case in question is in favour of the latter view, for from the want of parallelism of the eyes, it must be evident, that the images of objects must fall on non-identical, or non-corresponding parts of the two retinae, and yet no double vision resulted.

In Cheselden's 'Anatomy' there is related a case which corroborates the same fact. "A gentleman who, from a blow on the head, had one eye distorted, found every object appear double, but by degrees the most familiar ones became single, and in time all objects became so, without any amendment of the distortion."

Not less remarkable than single vision with both eyes, when the axes of these are not parallel, is the equal vision of the two, which

here existed. This is so rare, that I have met with but two examples of it in several hundred cases examined.

CASE 21.—Henry K—, æt. 10, was brought to the Dispensary on the 7th of February, 1854, for a styne on the outer part of the left upper lid; the eye on the same side was also considerably inverted. At first sight I concluded that this was a case of single convergent strabismus of the left eye; but on placing a book before it, I found the vision quite perfect; while on placing it opposite the other, or straight eye, he could with difficulty decipher the letters: this fact at once assured me that the latter was the really strabismic organ, and that the inversion of the opposite eye was only temporary; occasioned probably by the existence of the inflammatory swelling of the eyelid. In the course of a few days the styne had disappeared, and, as I had anticipated, the squint had disappeared with it, and had been transferred to the opposite eye.

February 21st.—This patient was again brought to me, and had I not previously examined the eyes, I should have doubted which was the one



affected, so continually did the squint shift from one eye to the other, and appeared to remain indifferently in either.

When the child looks straightforward without attempting to notice anything, the eyes are nearly parallel, but when he is asked to describe what he sees, as the number of fingers held up, the right eye becomes very much inverted. When they are at perfect rest, as in reverie, both are inverted, and slightly inclined downwards. With the left, or good eye, the "nonpareil" type can be easily read, and is seen clearly; with the right eye, the "pica" can with difficulty be made out, and the letters appear misty. A convex lens (No. 8) enabled the boy to read the "nonpareil," though even then it appeared less clear and distinct than to the other eye. On reading with the bad eye, the other being closed, the book was always held directly in front of him, and not at the side, or in the axis of the obliquity; and although I removed it myself two or three times in the axis of the distortion, on my leaving it to his own guidance it was always returned to the front of the face, and held very near to it.

In the power possessed by this patient of main-



taining the parallclism of the eyes, the case resembles those of 5 and 6, in all of which it might with truth be said, that if the eyes were straight, the patients could not see, and if they saw, the eyes could not be straight, clearly proving the influence of muscular action on the focus of the eye, a subject that will come under discussion in a subsequent part of this work.

CASE 22.—Mrs. S—, æt. 28, healthy looking, has convergent strabismus of the left eye, the pupil of which is more dilated than the other. Some difficulty was at first experienced in detecting the really squinting eye, as the squint alternated from one to the other, especially when the patient looked about her, or was excited by conversation; when she was quiet and unobserved, both eyes were seen to converge considerably. On being directed to look at a pen two or three yards in front of her, it was always regarded with the right eye, while the left was more or less inverted: also on closing each eye alternately, while the other was open and directed to an object in front of her, the right eye regarded the object when the lid of the other was raised;

but the left became inverted under like circumstances.

The vision corresponded with this ; that of the right eye was good ; but to the left everything appeared misty and indistinct, and only very large type could be read. Each eye could be everted till the margin of the cornea was concealed in the outer canthus.

The strabismus came on two years ago, without any obvious cause : the patient first observed the sight of the eye to be imperfect as she was walking along the streets ; but she has never experienced double vision. Her neighbours, she says, first made her acquainted with "the cast in her eye," and it has increased considerably within the last few months.

CASE 23.—Shortly before my return from the East, I was requested by Dr. M'Craith, of Smyrna, to operate on a young Greek lady, who squinted very decidedly, though with which eye it was difficult to determine, as the squint shifted from one to the other ; it seemed, however, to have a preference for the left. Walton's test, which succeeded so well in the last two cases, failed

completely in this, as when an object was regarded with one eye, the other being closed, it continued to regard it when the opposite eye was opened, and the same thing happened whichever eye was tried; so that this test would go to prove that the lady did not squint at all. On testing her vision, I found it most perfect in the left eye; that is, in the eye apparently most affected; it was not bad in either, the patient being able to read with both, though a smaller type with the left than with the right. Notwithstanding the right eye seemed to be the straight one, I operated on it rather than on the other, owing to its less perfect vision. The correctness of the diagnosis was at once made manifest, by the extraordinary size and toughness of the tendon of the internal rectus; as well as by the rectification of the deformity in the other eye.

CASE 24.—W. S—, æt. 15, an intelligent youth, has convergent strabismus of the left eye, which is more prominent than the other, and the vision of which is not quite so good, though the patient was unaware of the defect. He can read the "nonpareil" type with either eye, but the "pearl"

only with the right; a convex glass enables him to see as well with this as with the other. It is at times doubtful which is the squinting eye, as the distortion will sometimes remain for a considerable time in the right eye. On trying the test proposed by Mr. Walton, it failed, as, indeed, I believe it will do in all cases where the difference in the visual power of the two eyes is but slight.

*History.*—The patient had a severe ophthalmia when he was four years old, for which the eye affected was bound up. On the inflammation subsiding, he was found to squint with that eye.

November 14th, 1854.—I divided the internal rectus of the left eye without ehloroform, and subconjunctivally; but some inversion still continuing, I divided, with the seissors, the conjunctiva and subconjunctival tissue pretty freely, upwards and downwards, beyond the breadth of the adductor musele. They were much thickened. Quite far baek, beyond the anterior half of the eyeball, was felt, with the blunt hook, a strong eord attatched to the selerotie, and on this eord being divided, the eye lost all tendeney to inversion, and indeed could seareely be brought

beyond the central axis—no eversion followed, but some bulging. The sight became as good as that of the other eye.

February 20th, 1855.—The eye remains straight, but is slightly more prominent than the other, and the earuncle has retracted. During the treatment a fungus sprang from the sclerotic, and required removal two or three times.

October 20th, 1857.—I met this patient to-day, who recognised me, and stopped to thank me. There is now neither bulging of the eye nor retraction of the earuncle, and nobody would find out that any operation had been performed on the eye; indeed, a non-professional friend, who was with me at the time, guessed the wrong eye.

This case is given chiefly with the view of pointing out one of the causes of failure in operating for strabismus. In a case of congenital divergent squint of paralytic origin, which recently came under treatment, I found numerous tough fibrous bands firmly adherent to the posterior half of the sclerotic coat of the eye, and fixing it in its unnatural position; and notwith-

standing the adductor musele and the conjunctiva covering it had been fully and freely divided, the cornca could not be brought into the centre of the orbit till all of these bands had been divided.

I must aeknowledge that until I met with these two eases I was sceptical as to the existenee of such bands, although they had been well described by Mr. Duffin, many years previously, and pointed out by that gentleman as among the eauses of the operation occasionally not succeeding.

#### V. OF THE FIFTH FORM OF CONVERGENT SQUINT.

To those who have not had much experience of the deformity we are treating of, it may appear strange when I affirm that we possess no means of determining whether eertain cases of strabismus are single or double, except by operation ; yet such is the faet. Extreme or well-marked examples of the two affections are sufficiently distinct and recognisable ; but between these there is a gradual approximation of the characters

of one to those of the other, till any difference between them ceases to be appreciable.

Assuming one eye to be primarily and structurally affected, and the other only secondarily and functionally involved, there is a point at which the latter ceases to be only functionally implicated, its adductor likewise undergoing some slight structural change; but *when* it has arrived at this particular stage in the development of strabismus, or whether it was originally implicated along with the other eye, cannot be *à priori* determined. We judge, therefore, of the singleness or doubleness of any given case of strabismus, rather by the degree and the equality of the mutual convergence of the eyes than by any other sign; if both eyes are considerably and nearly equally convergent, we call the case double; if, on the contrary, the convergence is less considerable, or affects the two eyes very unequally, we call it single: still, as I have already remarked, in many cases of single strabismus, the participation of the sound eye in the inversion of the bad eye is so considerable, as to simulate double strabismus; and there are again, cases of the latter so slight, that they might readily be mistaken for



the former. In illustration of the truth of these remarks, I beg to refer my readers to Cases 11 and 12 among the examples of single strabismus, and to Cases 27 and 29 among the double.

CASE 25.—William B—, æt. 36, formerly a soldier, has convergent strabismus of both eyes, *i. e.*, they both converge unnaturally, and to about an equal extent. On placing myself in front of him, at a distance of four feet, he regards me with both eyes, one not being inverted more than the other. On directing him to look at an object at the opposite side of the room, both eyes appear to regard it, and are both slightly and equally convergent; occasionally, however, when unobserved, one eye will become more inverted than the other, so that he then appears to be affected with single strabismus. In the lateral movements, also, the squint becomes more apparent. He can evert each eye so as to bring the outer margin of the cornea to within a line or half a line of the external canthus. There is no difference in the vision of the two eyes, each being equally bad, so that he cannot read the “English” type with either, the print appearing:



misty and indistinct. A convex lens improves the sight, and he always makes use of spectacles of a high power when reading. He never, under any circumstances, sees double, though his attention has been frequently called to this phenomenon. He has squinted from infancy. While with his regiment in India, he suffered severely from ophthalmia in both eyes, and had caustic freely applied to the lids, but the strabismus was not increased by this attack.

CASE 26.—Sarah J—, æt. 24, a young woman from Berkshire, was sent to me by my friend Mr. White Cooper, to have my opinion relative to the expediency of performing an operation for the removal of a bad convergent strabismus of the right eye, in which the left slightly participated. It appeared that four months previously, this young person had had both her eyes operated on, with the view of remedying the strabismus; but the adductor muscle of the left eye only had been divided.

The condition of the eyes was as follows: During reverie both converged equally; but on scrutiny the left became straight, while the right

was more inverted, and was also turned slightly upwards. All the movements of the left eye were normal, but the everting power of the right was less than natural, and its inverting power greater; the effort to look far outwards was painful, and felt as if the eye were tied to the inner canthus. With the right eye no type smaller than the "English" could be distinguished, but with the left the "nonpareil" could be easily read. Before the operation above alluded to, the left eye was more inverted, and its vision very imperfect, and getting worse and worse: the patient attributed the strabismus to teething. As Mr. Cooper had requested me to undertake any operation I might consider expedient, on the 18th of February 1857, I divided the adductor muscle of the right eye, when it immediately became straight, and so continues to this day, February 20th, when examined for the first time after the operation. It has been covered up till the present moment with a bandage, on the removal of which, to her great delight and astonishment, she observed that the sight was as good as the other; and, on testing it, the "nonpareil" type was read with the greatest ease.

Although I did not see this patient before she was operated on by the first surgeon, there can be no doubt that prior to the operation she was the subject of true double strabismus, and the operation having been successful in one eye only, had converted the deformity from a case of double to one of single strabismus, with participation of the would-be straight eye in the inversion. Such was her condition when I first saw her.

CASE 27.—Louisa B—, æt. 7, has had convergent squint of the right eye, in which the left participates; the inverting power of each is much exaggerated, and the everting power slightly diminished.

*Vision.*—That of the right eye is so bad that the largest ordinary type cannot be read; with the left she can readily read the “brevier,” which was the smallest tried.

October 30th, 1856.—I divided, subconjunctally, the inner rectus of the right eye.

November 11th.—But little ecchymosis remains, and the appearance of the eye is wonderfully improved, as well as its vision. Though

perfectly straight, it can be inverted to a natural extent, or at least so far as to bring the margin of the cornea to the caruncle, and the eye has not bulged in the least. She can now read the "brevier" type with this eye as well as with the other. The left eye, which was not operated on, remains convergent to the same or nearly the same extent as before. I therefore, on the 13th, divided its adductor muscle, but by the old method.

20th.—Both eyes are now perfectly straight; but the one last operated on cannot yet be inverted, and some redness still exists on the site of the operation.

December 15th.—There is still some vascularity, and a small granulation is seen internal to the cornea, which was removed. The eyes continue straight, and the power of inversion has been regained in the eye last operated on.

My reason for performing the operation differently, in each eye of this patient, was to make trial of the comparative merits of the conjunctival and subconjunctival methods in the same individual; and one has only to examine the eyes of this child to be convinced of the superiority of the latter method.

CASE 28.—Charles M—, æt. 14, received a blow on the top of his head when six years of age, which was followed by strabismus. He has seven brothers and sisters, none of whom squint, nor does his father or mother. Both eyes converge; but the left most so, and none of the sclerotic is visible in this eye between the margin of the cornea and the inner angle of the lids; its inverting power is so great that the cornea can almost be buried out of sight, notwithstanding which it can be everted to within a line of the outer canthus. The right eye is but slightly affected in its lateral movements. He can make out the “nonpareil” type with each eye, though more easily with the right; he occasionally sees double.

On the 4th of February, the adductor muscle of the left eye was completely divided by the old method, without entirely removing the convergence, which continued three weeks after the operation. The adductor muscle of the right eye was then divided, upon which the left immediately diverged slightly, and so remained.

It would be difficult to find a case better calculated to demonstrate the close association between the position and movements of the two

eyes than the present, which may be compared with Case 5, illustrating the same truth. It is to be regretted that the subconjunctival mode of dividing the adductors was not adopted, as owing to the little disturbance of the conjunctiva by this method, eversion would probably have been prevented. I have never yet seen such a result after that operation, though it does occasionally take place after the old method. (See 'Edinburgh Medical and Surgical Journal,' vol. lv, p. 388.)

CASE 29.—Ann G—, æt. 17, has convergent strabismus of both eyes ; but most of the left eye, which appears slightly more prominent than the other. The motions of each eye are perfect, except in the outward and inward directions ; the former being limited, the latter exaggerated. With the left eye the patient can only make out a letter or two of "English" type, with the right "nonpareil" can be read with facility. The affection has existed since three years of age.

On the 20th of May, 1841, I divided the adductor muscle of each eye at one sitting, with perfect success, and without being followed by any eversion. The state of vision after the operation was unfortunately not noted.

CASE 30.—Charles H—, æt. 17, has had convergent strabismus of both eyes, the left being most inverted. The inverting power of each eye is very great, and their everting power slightly diminished. The patient can read with each eye singly, but best with the right; he occasionally suffers from double vision.

On the 17th of April, 1856, I divided the adductor muscle of each eye subconjunctivally, and under the influence of chloroform.

On the 2d of May my note-book states, that “the lad’s appearance is greatly improved, both eyes are perfectly straight and equally horizontal, parallelism is preserved in all their movements, which are perfect to the extreme of both eversion and inversion. The earuncle is well seen in both eyes. Vision in the left eye is much improved, so that he can easily read the “nonpareil” type; the vision of the right eye continues good, as before the operation.”

A curious phenomenon was now observed. It has just been mentioned that the patient was occasionally troubled with double vision; but since the operation this symptom has become constant. The images, though parallel, are not on the same level, the left being higher than the



right, if the object viewed be placed at a greater distance than sixteen inches from the face, but lower if the object be brought nearer; this is owing to the decussation which takes place at that, the focal point of most distinct vision.

To take another extract from my note-book: "Each image, as of a finger held up, corresponds with the eye of the same side, but the left, though parallel with, is higher than the other. On walking backwards from the patient the images recede from each other, and approximate on walking towards him; and when the finger is within sixteen inches of his face the images coincide, but what was the left is still higher than the right. On approaching the finger nearer than the point of coincidence of its images, these cross each other, what was the right becoming placed to the left, and *vice versâ*." These phenomena will be commented on by and bye.

July 11th.—The patient paid me a visit to-day: both eyes look very well and no perceptible difference is apparent in their position. The movements are perfect in every direction, and he is well pleased with his improvement; the double vision, however, remains.



## SECTION II.

### ILLUSTRATIONS OF DIVERGENT SQUINT.

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#### I. OF LUSCITAS, OR PARALYTIC DIVERGENT SQUINT.

This affection commonly goes by the name of paralysis of the third pair of nerves, inasmuch as the muscles supplied by one of these cerebral nerves are paralysed. The symptoms are a dropping of the upper lid (ptosis), a dilated and immoveable pupil, an everted eyeball, and a want of power to move it in any other direction than outwards; it is already drawn slightly in this direction by the passive contraction of the unopposed abductor muscle; but it can be voluntarily turned outwards to the full extent. A slight movement of the globe on its antero-posterior axis, produced by the superior oblique muscle, may also frequently be observed when

the patient endeavours to look outwards and downwards with the paralysed eye. These symptoms occasionally come on gradually, and disappear in the same manner, one muscle after another either losing or recovering its power, till all are paralysed or all restored. There are also different degrees of paralysis. All these circumstances occasion some modification of the subjective symptoms: thus, if the elevator muscle of the upper lid have escaped paralysis, or be only slightly affected, the patient will experience considerable confusion of vision, to avoid which he usually keeps that eye closed; or covers it with a shade. This confusion of vision arises partly from the eye being out of focus, but chiefly from its being out of position, so that all objects seen with the paralysed eye are indistinct and out of place, and double vision necessarily results. I recently had under my care an interesting case of this description, which I here subjoin.

CASE 31.—Mr. R—, æt. 66, a person in a respectable station of life, attempted suicide by cutting his throat, and was brought into the

Westminster Hospital, where he came under my charge. Shortly after his admission I observed that the pupil of the right eye was more dilated than its fellow, the eye also lacked expression, and the patient was in the habit of closing it whenever he looked at anything. On his recovery from the injury he had inflicted on himself, I found, as I had expected, partial paralysis of the motor oculi nerve of the right eye. There was no ptosis, nor was the eye everted, or to speak more correctly, these symptoms existed in so slight a degree as to be scarcely appreciable to an ordinary observer; the patient, however, possessed no power of moving the eye inwards, upwards, or downwards, though he could evert it to its full extent. There was misty vision with the paralysed eye, and double and confused vision when both were used.

These symptoms I ascertained came on five years ago without obvious cause. The patient had applied for advice to several medical men, and likewise at two ophthalmic institutions; but no one, according to his account, had discovered the paralysis. On the contrary, he was told at one of these charities that he had cataract,

and must wait till he got worse before anything could be done for him. The dread of becoming blind, rendered him so despondent that he committed the rash act for which he came under my care.

Paralysis of the orbital muscles may arise from any of the causes by which paralysis generally is produced, and these causes may be located either in the brain or in the nerves connected with it. Hence, slight apoplectic effusions, tumours, disease of the bones forming the base of the skull, injuries involving the nerves or muscles of the orbit, may all give rise to it.

In the two following cases the cause was evidently cerebral, probably apoplexy.

CASE 32.—J. J—, æt. 35, a patient of Mr. Paget's, who kindly afforded me an opportunity of examining and taking notes of the case, had been ill thirteen weeks with threatened apoplexy and hemiplegia, from which he was recovering when I saw him, on the 27th of August, 1842. At this time he was the subject of paralysis

of the motor oculi nerve of the left side, of which the following were the symptoms, as extracted from my case-book.

“Ptosis of the left lid, on raising which, both eyes are seen to be on the same horizontal level. The left eye is everted, but can be brought into the centre of the orbit, though not beyond it; the eye can also be slightly elevated and depressed, and, on attempting to look downwards and outwards, it is rolled on its antero-posterior axis by the superior oblique muscle. The pupil is in a medium state between contraction and dilatation; but more dilated than that of the other eye, and motionless under variations of light. There is no lachrymation on exposing the eye. Its vision is presbyopia and misty, and objects appear more illuminated than they do to the other eye.”

CASE 33.—*Partial paralysis of the left half of the body, and of the right motor oculi nerve.*

George S—, æt. 23, (tailor), was admitted into St. Bartholomew's Hospital on the 15th of October, 1839, under the care of Dr. Hue, with

slight hemiplegia of the left side, and partial paralysis of the muscles supplied by the third cerebral nerve of the right side. The eyelid of the right eye was closed, but could be opened to about half its extent by a voluntary effort. There was dilatation, but not immobility of the pupil, and vision was indistinct and nebulous. The patient had no power to roll the eye directly upwards, but he could move it inwards, and also downwards in a slight degree, and to its full extent outwards.

*History.*—The ptosis came on ten days before his admission; but six weeks previous to this, he was attacked one night, while in bed, with great pain in the head, and a sensation of numbness on the left side; and the symptoms have continued without abatement to the present time. He had been cupped three times without relief. Under the use of mild mercurials with conium, counter-irritation by blisters to the back of the neck, and friction of the forehead with veratria ointment, followed, subsequently, by the exhibition of quinine three times a-day, and a generous diet, this patient recovered sufficiently to be made an out-patient, when I lost sight of him.

CASE 34.—W. T—, æt. 32, a bricklayer's labourer, applied at the hospital, March 11th, 1856, for paralysis affecting the motor oculi nerve of the left eye. There was incomplete ptosis, eversion of the cornea, and dilatation of the pupil. The patient could bring the cornea into the centre of the orbit, but could not invert it. On looking downwards and outwards, scarcely any rotation of the eye on its antero-posterior axis could be perceived; neither was the cornea inverted, when the patient endeavoured to close his lids while they were held apart with the fingers.

*Vision.*—With both eyes open, his sight is very confused and double, though these symptoms do not trouble him so much as they did at first. The double images do not occupy the same plane; but that belonging to the bad eye is higher than the other, and seen to its right; thus, on looking at me standing a few feet in front of him, my image appears to his left eye to his right and above the other, and “of larger size, and all of a move.” When the right or good eye is closed, objects appear to the other more illuminated, misty, and “on a move,” and



they are seen better when held in front of the eye than on one side. The letters of a book cannot be distinguished when placed at the ordinary reading distance or nearer, but when the book is held at arm's length, he can decipher them.

*History.*—The paralysis, he says, came on five or six weeks ago with pain in the head; but as far back as Christmas, he experienced some confusion of vision, and once or twice narrowly escaped severe accidents in consequence. He has been cupped and leeches to the temples with great relief to the pain; but the paralysis has undergone no visible diminution. The tartar emetic ointment was ordered to be rubbed behind the neck every night, and five grains of the Pil. Hydrargyri were prescribed night and morning.

18th.—A copious eruption of pustules has been brought out by the ointment, but the symptoms have undergone no improvement. On asking him again about his double vision, he illustrated it by saying that, when walking along the towing-path by the side of the canal, he saw two paths, with the canal between them; one of these paths diverged from the other to the right.



and he had to avoid taking that, by keeping close to the left side, or he would walk into the canal.

April 28th.—Although slight counter-irritation has been kept up by the ointment, and the pills have been perseveringly taken, no visible effects have yet been produced. He complains a good deal of the confusion and doubleness of vision, and of the constant movement in which all objects appear to be, to the affected eye.

December 20th.—The patient ceased to attend, or to use any remedies after the date of the last note; but called on me to-day to show himself. He says the eye has been all right for the last two months. At present he can move it freely in all directions, but not quite so far inwards as the other; the upper lid still droops slightly, and the pupil is a little more dilated than its fellow; but beyond this, no other traces of the disease remain. On placing a book before him, and shading each eye alternately, he declared that he saw as well with one as with the other, and that the letters had no want of definition.

The double vision with which this patient was affected will be commented on in the chapter on

Diplopia, where also will be found some remarks on Case 30.

## II. OF THE SECOND FORM OF DIVERGENT SQUINT.

The second form of divergent strabismus, of which I shall give an example, is distinguished from all other forms by the power which the patient possesses of retaining the eyes parallel to each other, and even of making them converge slightly. The character of the eversion is entirely passive; that is, it does not result from any spasm, contraction, or shortening of the abductor muscle, but the function of the eye being annihilated, volition is no longer directed to it, and thus, being left as it were to itself, it simply takes the direction of the axis of the orbit.

CASE 35.—A gentleman was under my care some few years ago, with symptoms of amaurosis, which terminated in total loss of vision of the left eye, and considerable impairment of that of right. Some months after the sight of the left eye was lost, it was observed that when the

patient looked at near objects, this eye was less convergent than the right, and shortly afterwards it began to be everted, in which position, under ordinary circumstances, it still remains.

There is this peculiarity, however, which distinguishes the eversion from that of ordinary divergent squint. By an effort of volition directed to the squinting eye it can be brought parallel to the other, and some degree of mutual convergence can even be produced.

There is a form of eversion somewhat allied to that of which the case just given is an example, so far at least as the eversion is consequent on previous lesion of the function of the organ; but it differs from it inasmuch as the distortion seems to be due to a reflex action of the abductor muscle, in order to bring the least diseased part of the retina into the direct axis of vision.

CASE 36.—John C—, æt. 59, was under my care, as a dispensary patient, in September, 1848. He has divergent squint of the left eye, with imperfect vision. The iris of this eye is tremulous on every movement, and acts somewhat sluggishly; the pupil is clear, and of the same size

as the other. On closing the sound eye, the left one becomes straight, and everything is seen with it in a thick fog, and out of its proper direction, so that, were the good eye bound up, the patient would be constantly running against objects; the direction in which these are seen is to his right; so that on holding up a finger about two feet in front of his face, and telling him to grasp it, he always elutes at it about half a foot to the right of its proper position. He never sees double, and, when both eyes are open, he experiences no confusion of vision.

As this case was under treatment before the introduction of the ophthalmoscope, it is impossible to say what might have been the nature of the lesion which limited the greatest sensibility of the retina to one point, and that not in the normal axis of vision, but external to it.

This seems to be one of those cases of which we have had parallel examples among the cases of convergent strabismus (Cases 8 and 9). In each of these the distortion was probably due to reflex action, by which the most sensitive part of the retina was brought into the direct axis of

vision, and thus made to act with and assist the other eye. The phenomena which were observed when the good eye was closed are thus explained : The best seeing point of the bad eye being external to the normal point, objects directly in front of the patient could only be seen in their proper position when the eye was everted, so as to bring this point opposite them, or in the line of the axis of the abnormal point. Consequently, when the eye was straight, the axis of the seeing-point would be oblique, and objects would be seen in the direction of this obliquity, that is, to the right of their actual position.

In confirmation of the remarks made at p. 31, I may refer to a remarkable case related by Mr. Elliot, in the fifty-fifth volume of the 'Edinburgh Medical and Surgical Journal,' p. 387. In this case, on shading the sound eye, the squinting one remained inverted when looking at an object placed in front of it; and, to render it straight, the object required to be moved to the outer side. Four months after the operation, which was double, the eyes, when both open, were perfectly parallel; but on closing the good eye, the formerly squinting one immediately became in-

verted, thus demonstrating the important fact, that the normal point of most acute sensation of the retina still remained less sensitive than the abnormal, notwithstanding the rectification of the eye had placed it in a most favorable condition for acquiring strength, and had in the same proportion placed the abnormal point at a disadvantage.

### III. OF THE THIRD FORM OF DIVERGENT SQUINT.

This, which is the most frequent, and the usual variety of divergent strabismus, is characterised, like the corresponding variety of convergent squint, by the ability which the patient possesses of moving each eye, singly, to its natural, or nearly natural, extent in all directions; but when both eyes are employed in vision, they cannot execute certain combined movements of which healthy eyes are capable. Thus, they cannot be made to converge, as in viewing near objects, nor can they even be brought parallel to each other; but if one eye is straight the other is everted, or if one be made to converge, the eversion of the other is ex-

aggerated, so that, even in the lateral movements of the eyes, parallelism is not maintained, one eye being too much everted, and the other not sufficiently inverted. The causes of divergent squint do not differ from those by which the convergent form is produced, and the explanation of the phenomena of the latter is, *mutatis mutandis*, equally applicable to the former. The following case is a well-marked example of divergent squint of inflammatory origin—

CASE 37.—Charlotte B—, æt. 48, was in the Westminster Hospital, June, 1854, for some pectoral complaint, under the care of Dr. Kingston. When this patient is unobserved, and the eyes as in reverie, both are slightly divergent; the right more so than the left. The cornea of the right eye has a dense opacity on its inner half, which encroaches somewhat on the pupil at its inner and inferior margin; indeed, this aperture is not quite round, but slightly oblong, from an adhesion which has taken place between it and the cornea opposite the opacity. The left cornea is free from disease. Both eyes, individually, move freely in every direction; but not quite to so



great an extent inwards as outwards. They cannot both be made to converge together; on attempting this, the left eye only converges, the right diverges. The vision of this patient is so imperfect, that she cannot read without powerful convex lenses; with these the "nonpareil" type can be made out with each eye. The strabismus is attributed to a severe and long-continued inflammation of the right eye when four years of age, produced by a little girl putting her finger into that eye.

CASE 38.—Miss G—, æt. 21, was sent to me by Dr. Protheroe Smith, May 20th, 1856, for divergent strabismus of the right eye, which had existed from infancy, and was supposed to be caused by an ophthalmia from which she then suffered. There is a slight nebula on the centre of the cornea, and the vision of the eye is very imperfect, more so than can be accounted for by this opacity. The patient cannot make out any letters of a large type, though she can distinguish them as print. The movements of this eye are perfect in every direction, but the two eyes cannot be made to converge together.



On the above date I divided the external rectus of the eye affected, together with the conjunctiva; but the operation failed to remove the eversion completely, though the position of the eye was improved, and the patient could not evert it to the same extent as before.

July 31st.—A variety of means have been made use of since the operation, to improve the position of the eye, but without effect. I therefore redivided the external rectus, and removed a good piece of conjunctiva internal to the cornea, still without bringing the eye into a perfectly central position.

August 30th.—The position of the eye is certainly better than before the operation, though even now the two eyes are not quite parallel when looking at an object in front of her. This evidently depends on the other eye slightly participating in the affection, and I proposed to operate on that; but she objected, because the lady who had engaged her as a governess to her children could see nothing the matter with her eyes. This was satisfactory; inasmuch as, previously to the operation, this patient had failed in obtaining a similar engagement, owing to the deformity.

CASE 39.—Emma U—, æt. 17, has had divergent strabismus from birth. The squint is continually shifting from one eye to the other, and in reverie, both slightly diverge; there is also an oseillatory movement from side to side, and slightly from above downwards, but none on the antero-posterior axis. The vision of the right eye is good; but of the left imperfect, a short word in “small piea” being with difficulty made out, and to do this the book is held close to the face, and the head inclined to the left shoulder; with a convex lens she can see well with this eye. When fatigued, she frequently sees double. The power of inversion of both eyes is less than natural.

On the 2d of August, 1856, I divided the external rectus of each eye subconjunctivally; no chloroform was given, and the patient behaved admirably. The left eye still had some tendency to eversion, but its vision was improved, so that she could now read with it the “brevier” type.

August 4th.—Some ecchymosis remains; but both eyes are now straight, and the improvement of vision in the left continues.

## SECTION III.

### ILLUSTRATION OF DOWNWARD SQUINT.

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IN my 'Lectures on Strabismus,' after enumerating the more frequent varieties of this affection, I stated that examples were occasionally met with in which the cornea was neither inverted nor everted, but directed upwards or downwards, and one of my reviewers asks whether I have ever seen such a case. The following will perhaps remove his doubts.

CASE 40.—Ellen T—, æt. seven months, was brought to the Westminster Hospital on the 21st of June, 1854, and came under the charge of my colleague, Dr. Radcliffe, for some pectoral complaint; but the child's appearance being very peculiar he requested the mother to show her to me. The left eye of this little patient was less prominent and smaller than the other, looking as

if atrophied, but its tension was natural. A dense leucoma occupied the cornea, leaving only a margin of about a line in breadth, above and below, of transparent or healthy structure. The pupil of course could not be seen, and a solution of atropine dropped into the eye failed to render it visible. The cornea of the right eye had a nebulous opacity occupying its lower half, so that the upper margin of the pupil only was visible. This condition of the cornea of the two eyes had given rise to strabismus directly downwards, in which the left eye was affected to a greater extent than the right. To such a degree was the former depressed, that the cornea was frequently entirely concealed by the lower eyelid, giving to the child a most peculiar and remarkable appearance. Although the eyes were more frequently in this position than any other, there was no want of power to move them in other directions, and they rolled about as if in search of objects, and were never steadily fixed in any other direction than directly downwards.

This condition of the cornea was the result of purulent ophthalmia of nearly two months' duration.

This case is interesting, not merely on account of its rarity, but from the light it throws on the pathology of certain forms of strabismus. It may seem, at first sight, impossible for one eye to move independently of the other, or rather not in unison with the other, yet this is constantly observed to take place in patients who are not confirmed squinters, though it too frequently terminates in their becoming so. Sometimes it would appear to be a result of spasm; sometimes of a reflex act; and sometimes of a powerful voluntary effort, exclusively directed to one eye. In the latter case, although both eyes must necessarily be acted on, it seems that the contraction of the muscles of the one to which volition is specially directed, would be more energetic than the contraction of those of the other.

## CHAPTER II.

### ON THE PATHOLOGY OF STRABISMUS.

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THIS is confessedly one of those difficult subjects that few have eared or dared to discuss; yet without an attempt in this dircetion, it is clear no advance can be made. Now data are not wanting, an analysis of which could not fail to throw some light on this obscure subject, and of these I shall avail myself in the present attempt to elueidate the pathology of strabismus. These data are supplied by—

- 1st. The history and morbid anatomy of strabismus, and of certain allied deformities.
- 2d. The phenomena presented.

1st. *The history.*—Strabismus, as we have seen by the eases narrated in this work, may originate in a variety of eauses, or may come on, spontaneously and unaccountably, in individuals otherwise perfectly healthy.

In the accompanying tables of the alleged causes of strabismus I have added to my own collection that of Dr. Radcliff Hall's 200 cases, making altogether 378 cases. In Table I, these cases are arranged in the order of frequency of the supposed cause. In Table II, they are grouped under four heads, to one or other of which every case may be referred : thus, strabismus following convulsions, or a blow on the head, there can be little doubt is of nervous origin ; while the same may be affirmed of strabismus arising from disorders of the alimentary canal, worms, teething, &c., the former directly, the latter indirectly through reflex action.

The different forms of ophthalmia, so fruitful in the production of the deformity we are treating of, may give rise to it in different ways, of which we shall have to speak hereafter ; but in any case, strabismus arising from this cause may fairly be said to be of inflammatory origin.

In the strabismus coming on after smallpox, measles, scarlatina, &c., of which twenty-four cases are given in the table, some were attributed to the ophthalmia accompanying these diseases, and some were independent of this cause.

As my data make no distinction between these cases, I have divided them equally, and placed half among those of nervous origin, and half among those of inflammatory.

A large number of cases of strabismus still remain, which cannot be placed in either of the two former divisions, and from their coming on after frequent action of certain muscles, I have placed them to the account of hypertrophy.

A fourth division or group includes all those cases which have either come on spontaneously, or the cause for which was not known, or was not noted.



## TABLE I.

Ophthalmia, idiopathic and traumatic . . . . .	87
Unknown or unnoted causes . . . . .	83
Imitation . . . . .	52
Convulsions and fits . . . . .	28
The eruptive fevers . . . . .	24
Frequent inversion of one or both eyes to regard something, &c. . . . .	20
Congenital . . . . .	19
Blows and injuries of the head . . . . .	18
Hooping-cough . . . . .	11
Indigestion and constipation . . . . .	8
Difficult dentition . . . . .	6
Epilepsy . . . . .	3
Blisters behind the ears . . . . .	3
Venereal excesses . . . . .	3
Worms . . . . .	3
Fright . . . . .	2
Mental fatigue . . . . .	2
Burns on the abdomen . . . . .	2
Hydrocephalus . . . . .	1
Cerebral congestion . . . . .	1
Pregnancy . . . . .	1
Headache . . . . .	1

## TABLE II.

*Strabismus of nervous origin.*

Arising from disease or injury of the nervous centres or nerves . . . . .	93
Congenital . . . . .	19
The eruptive fevers . . . . .	12
	<hr/>
	124

*Strabismus of inflammatory origin.*

Arising from or immediately following inflammations, or injuries of the eye, cataract, amaurosis, &c. . . . .	87
The eruptive fevers . . . . .	12
	<hr/>
	99

*Strabismus of hypertrophic origin.*

Arising from overaction of one of the recti museles . . . . .	
Imitation . . . . .	52
Frequent inversion to regard an object, &c. . . . .	20
	<hr/>
	72

*Strabismus of uncertain origin.*

Arising from unknown causes . . . . .	83
	<hr/>
	378

Seeing then that strabismus may be produced by such a variety of exciting causes, the question arises, what is the effect of these on the muscles, which are the immediate agents in the production of the deformity? In reply to this, I would invite attention to the following changes which have been observed in the orbital muscles of squinters.

The first is that of passive or tonic contraction, which ensues on paralysis of an antagonist—a condition which may be recovered from—as seen in Cases 1, 32, 33, 34. It appears probable however, from Cases 3, 4, and 31, as well as from the dissections which will be presently given, that if recovery be delayed beyond a certain time, a change may take place in the contracted muscle and permanent deformity be thus produced. This change consists either in simple hypertrophy of the contracted muscle; or this condition may be combined with structural shortening and degeneration of the muscular tissue.

A patient who had been the subject of paralysis of the motor oculi nerve of one side, having died, Mr. Struthers embraced the opportunity of examining the contents of the orbit. No disease

was discovered in the brain or in the nerves ; but the latter were atrophied, and probably the former, as there was large serous effusion. The external rectus muscle was *heavier than that of the sound eye*, all the other muscles, except the superior oblique, *were lighter*. (See 'Edinburgh Monthly Journal,' for July, 1853.)

Somewhat analogous to this case is one that has been described by Mr. Partridge, and is published in the first volume of the 'Transactions of the Pathological Society.' A man thirty years of age, who had squinted badly from childhood and whose eye participated but slightly in the movements of its fellow, died. The external rectus muscle was elongated and much attenuated ; the internal rectus was *short, bulky, and had a much thickened tendon*, scarcely differing in appearance from cellular tissue ; while the other orbital muscles were of their ordinary size, though a little paler than natural. Under the microscope the muscular fibrils, except those of the levator, appeared to be made up of mere granular matter enclosed in the usual sarcolemma sheaths, only here and there a few striped fibres were observable, and in the internal rectus they

were scarcely to be detected. All the branches of the third nerve were healthy; the sixth, just after its entrance into the orbit, had a light gray semi-transparent look, and in its trunk was an oval enlargement about the size of a pin's head.

In the two dissections just given, the hypertrophy was a sequence and probably a consequence of paralysis of an antagonist: in other cases, as where the strabismus follows convulsions, it is probably the direct result of violent spasmodic action of the muscle itself. Thus, in a case reported by Mr. Bennett Lucas, and attributed to convulsions that had occurred twenty-one years previously, it was found unusually developed, fully twice as large as natural, and powerfully contracted. Also in the case of a boy ten years of age, reported by the same author, the strabismus came on suddenly after a severe convulsion at two years of age, and the tendon was unusually thick and strong, and grated beneath the blades of the scissors.

Hypertrophy may also be caused by frequent and violent *voluntary* contraction, as in the following case, related by Mr. Middlemore.

A young man was accidentally burnt on the

outer part of the eye ; this was followed by adhesion between the palpebral and ocular conjunctiva, the eye was drawn outwards and its movements much impaired. By the frequent and strong action of the internal rectus these adhesions were at length overcome, and the patient was able to move the eye inwards nearly to the same extent as the other. Shortly after this he died, and Mr. Middlemore embraced the opportunity thus afforded him of examining the muscles of the orbit. The internal rectus was found to be much enlarged and thickened and very strong.

Reasoning from analogy, then, it would appear probable that frequent and strong contraction of one of the straight muscles—whether to overcome mechanical obstacle, as in the case just cited, to look under a bandage, as when the eye has been bound up for ophthalmia ; or to imitate another who squints—may cause hypertrophy of the muscle so employed ; and reasons will be given hereafter for believing that this alone, without any shortening of the affected muscle, must be productive of strabismus.

The opposite condition to hypertrophy has been met with in a few instances. Thus, Lucas gives

a case of divergent squint in which the external rectus was found remarkably wasted, and after its division the internal rectus could only draw the cornea as far as the inner canthus. Elliott also observed the same fact in a case of divergent squint, the external rectus being scarcely thicker than a crowquill. It is to be regretted that no history is appended to either of these cases.

It would appear then from the foregoing observations, that strabismus may be associated with the following museular conditions, viz.,

1. Simple passive contraction, in consequence of paralysis of an antagonist.

2. Hypertrophy, with or without structural shortening.

3. Structural shortening with atrophy.

An arrangement of these, according to their supposed cause and order of sequence, may be made thus.

### *Paralytic Cases.*

1. Simple passive contraction of a healthy muscle from paralysis of an antagonist. (See Cases 1 and 34.)

This may be followed after a time by—

2. Hypertrophy of the passively contracted muscle (Struther's case).

After a longer interval, it seems probable that a further change may take place; one namely of

3. Structural shortening and thickening of the contracted muscle, with degeneration of its tissue. (See Case 4 and Partridge's.)

A still further change seems not improbable; one namely of

4. Complete atrophy of the shortened and degenerated muscle. (See Lucas and Elliott's Cases.)

#### *Non-paralytic Cases.*

1. Simple hypertrophy from over-use, the antagonist being healthy. (Middlemore's Case.)

2. Hypertrophy with structural shortening, the result usually of violent spasmodic action, the antagonist being healthy. (Lucas's.)

Such then are the deviations from the healthy structure which have been discovered in the orbital muscles of squinters. It must however be acknowledged, that the instances in which any of the above-named changes have been observed are so few, that writers have abstained from ap-



plying these data to all cases, and an opinion has come to prevail that the deformity we are treating of, is not due to any muscular change, but to a mere mal-association of the movements of the two eyes, dependent on causes "deeper than the muscles of the eye, and deeper even than the retina, viz., the brain and nerves, the organs which govern the associated actions of the muscles of both eyes," and the dissection of Cavarragh, who found the orbital muscles and nerves healthy; but the crus cerebelli deficient, seems to countenance this view. Without denying the occasional production of strabismus from such a defect of the co-ordinating power of the brain, I hope to be able to show that this is not the usual cause of distortion; but that it is really owing to one of the changes in the muscular apparatus of the eye which have been already described, although they may not have attained such a degree of development, as would render their existence too manifest to be overlooked. The evidence then which I am about to adduce, will go to show that there is, in nearly all cases of permanent strabismus, either some structural shortening or hypertrophy of the muscle towards which the eye is drawn; and, if

such changes have not been recognised, it is not because they have no existence; but rather because they have not been looked for, or are so slight as to have escaped observation. The evidence in support of these views is to be found in—

2d. *The phenomena of strabismus.*—If an individual, affected with ordinary convergent strabismus, be examined before and after division of his external rectus, the following facts may easily be verified:

1. The affected eye can seldom be everted quite to the natural extent before operation, though it can always be so afterwards. The latter fact proves that the external rectus was not at fault, and consequently that the want of power to effect the movement previous to the operation, was due to the shortening of its antagonist. 2. The cornea of the squinting eye cannot, in most cases, be brought into the centre of the orbit without causing inversion of the sound eye; this depends on the excess of force exerted by the external rectus of the squinting eye, in order to overcome its shortened or hypertrophied antagonist, and this extra force acts on the internal rectus of the sound eye and draws it

inwards—another proof that the fault is not in the external rectus, but in its antagonist.—3. The cornea of the affected eye can always be inverted to an unnatural extent; this exaggerated power of inversion, so much beyond that of which a healthy eye is capable, is inexplicable on the supposition of the internal rectus being of its normal length only, for Bernoulli has proved that the greatest contraction which takes place in any of the recti muscles, scarcely amounts to one-fifth of their length; so that did no shortening exist, inversion ought not to take place beyond the usual limits. 4. An eye affected with paralytic convergent strabismus cannot be inverted so far as one of the ordinary variety; yet were no shortening present in the latter, the reverse ought to be the case. 5. In a very large proportion of strabismus cases (about 99 per cent.) the vision of the distorted eye is impaired. This imperfection of sight is due either solely to presbyopia, or to presbyopia combined with other causes; and this presbyopic condition is caused by the altered form of the eye-ball, produced by the contracted internal rectus: to bring the cornea into the centre of the orbit, the external rectus

must exert abnormal power ; the globe of the eye is therefore somewhat approximated to an oblate spheroid, and this is incompatible with distinct vision—the proof of this position is the immediate removal of the presbyopia on the division of the internal rectus. 6. Division of the internal rectus of a squinting eye frequently causes it to start forwards and project, more than division of an unshortened muscle would do ; judging from what is observed in paralysis of the motor oculi nerve. Lastly, among the subjective phenomena must be placed the patient's own sensations. Many complain of the dragging sensation they experience in the inner part of the eye when looking in an opposite direction ; while others, when told to look outwards with the squinting eye, volunteer the remark that they cannot see so far outwards with that eye as with the other. (See Cases 5, 26, 46, and 47.)\* If then, the foregoing phenomena be present (as they are in the majority of strabismus cases), it seems impossible to resist the conclusion that the internal rectus is shortened ; and if division of this muscle should not only rectify the distortion, but restore the harmonious action of both eyes, we arrive at

\* For Cases 46 and 47, *vide* 48 and 49.

this further conclusion, namely, that the phenomena were due to the shortening, and did not arise from any defect in the co-ordinating function of the brain. It being admitted then, that permanent strabismus is attended with more or less alteration of the bulk or structure of one or other of the orbital muscles, we are in a position to inquire by what means such has been brought about.

*Of Strabismus of nervous origin.*

In reference to this form of strabismus, it is scarcely necessary to dwell on the paralytic variety, as its pathology is sufficiently understood. Suffice it to observe, that paralysis of one muscle necessarily induces contraction of its antagonist, and thus gives rise to deformity. Illustrations of this fact are met with in abundance in all parts of the body; as in the face, where the features of one side become distorted from paralysis of the muscles of the opposite; and in the extremities, where the different varieties of club-foot and club-hand originate in a similar manner. Distortions thus arising are frequently recovered from, as we have already seen; but the dissection of Mr. Struthers demonstrates

that, after a time, the passively contracted muscle undergoes a change in its nutrition; becoming hypertrophied, and rendering it probable that the deformity may thus be converted from a temporary to a permanent one. There is also reason to believe, from what has been observed in club-foot, that another or a further change may be one of structural shortening. There is a form of contraction met with after paralysis, which differs altogether from that last described, inasmuch as it affects the paralysed muscles themselves, not their healthy antagonists. This contraction of paralysed muscles has been well described by Dr. Todd, and will be found published in the thirtieth and thirty-sixth volumes of the 'Transactions of the Royal Medical and Surgical Society,' as well as in the admirable clinical lectures of that accomplished physician; but I have not been able to satisfy myself that strabismus ever occurs in this manner, or if it do, I have not yet met with an instance in which it could be traced to this cause. In fact, the history of the greater number of strabismus cases of nervous origin, points to *spasm* as the primary cause of distortion; did the latter occur through con-

traction of a paralysed muscle, there should have been previous distortion in an opposite direction, a fact I have been unable to verify. We must therefore dismiss from consideration these paralytic contractions as inapplicable, and confine our attention to spasm, and the structural shortening thence resulting. That most cases of nervous strabismus originate primarily in spasm, may be inferred from the following considerations. The frequently sudden access of squinting after convulsions, while there is an absence of all traces of paralysis—the production of other deformities by presumed similar agency—the co-existence of a similar condition of the muscles in other parts of the body, and lastly—the absence of any other known cause capable of producing the contraction. In confirmation of this view we have the evidence of Little, Adams, Brodhurst, Guerin, and others, that spasmodic talipes and strabismus frequently co-exist, both congenitally and otherwise. Brodhurst also has observed that when one limb only is affected with talipes, and strabismus exists, the latter is always on the same side, showing the central origin of the two affections. Dr. Little relates the case of a child who was born



“ with spasm of some of the muscles of the eyes, of the spine, of the adductors of the thighs, and muscles of the calf—producing squinting, partial opisthotonos, rotation inwards of the thighs, and double talipes equinus ;” the whole of which were removed, except the strabismus, by tonics, laxatives, and counter-irritants to the spine. Dr. Little hence infers, that talipes and strabismus have a common origin and are accompanied by a similar condition of muscles. Adams remarks, “ the great result which we observe in the muscular structure, alluding to club foot, is tonic spasm which never relaxes, and which by its continuance, gives rise to structural shortening of the muscles affected and thus produces the deformity ;” and speaking of the effect of this spasm on the muscular structure, he says, “ generally in spasmodic cases of club foot, the ultimate muscular structure appears to undergo but little change.” Thus, taking these conditions of muscle in club foot as a guide, we may assume that convergent strabismus of nervous origin may arise from spasm of the internal rectus, which may terminate eventually in structural shortening of the muscle. It is to spasm that we must



attribute the frequent occurrence of temporary strabismus in childhood, brought on as is well known by a variety of causes ; as worms, indigestion, or any irritation in the alimentary canal. Some children are subject to these attacks whenever their health suffers by any of the causes enumerated above, and as frequently recover from it on the removal of them ; but, if they are unheeded, the squint after a time becomes permanent, and then the remedies which at an earlier period of the deformity would have removed it, are no longer competent to do so ; for the muscle has become permanently shortened, and the squint can only be removed by its division.

The fact that muscle long affected with spasm may, during the continuance of this condition, become shortened, explains how a distortion may come to be permanent, notwithstanding the affection which gave rise to it has been recovered from. The fact, too, stated by Adams that there may be shortening without any appreciable alteration in the muscular structure, will explain the want of success of those who have sought for evidence of disease in the orbital muscles and nerves.

It would appear, then, from the history of strabismus cases of nervous origin, from their analogy with those of club foot, from their not unfrequent occurrence in conjunction with this deformity, and as a part and parcel of the same disease, that in a large number of instances they originate in spasm of the internal rectus muscle, and subsequently that some shortening takes place in the same.

*Of Strabismus of inflammatory origin.*

The frequent occurrence of strabismus after inflammations of the eye, is a fact too well established to be called in question; but the exact mode in which the distortion is brought about in these affections, is probably not in all cases the same. Thus, when it has followed the binding up of the inflamed eye, it may be that the frequent and persevering attempts of the patient to look under the bandage, as in Case 15, have caused some hypertrophy of the adductor muscle; but the most probable explanation is the following: An ulcer, we will say, has formed at the edge of the cornea, to avoid the pain occasioned by the friction of the eyelids, the eye is turned inwards and, this being the easiest position, it is kept there as much as possible; meanwhile the inflammation persisting, inflammatory exudation probably takes place in the subconjunctival tissue, glueing together conjunctiva, sclerotica, and muscle; while the latter, at the same time, gradually becomes shortened and so adapted to the altered position of the eyeball. This is in consonance

with what is observed in other parts of the body : thus, if inflammation attack any of the joints, the hip, knee, elbow, or fingers, for example, the limbs are instinctively placed in that position which is easiest to the patient, and the muscles which so retain them, soon adapt themselves to the position, become shortened, and ankylosis and permanent deformity result. The same shortening of muscles is also observed in unreduced dislocations, and in fractures with overlapping of the bones. Club-foot, according to Adams, is not unfrequently produced in a similar manner. "Wounds and abscesses," observes this surgeon, "in the muscles and neighbourhood of joints are frequent causes—serofulous abscesses in the course of the great muscles, diffuse inflammation in the cellular tissue, deep sloughs, cicatrices from burns, contractions of fasciæ, as in the hand and foot, contractions of fasciæ and muscles from long-retained position." Duffin has observed that, when the eyes during childhood have been repeatedly affected with strumous or other inflammation, the whole of the muscles and investing cellular tissue of the eye may be found in a morbid condition, condensed, and ex-

tremely adherent to the sclerotica. This condensed tissue, he states, may subsequently be elongated by the motions of the eye into bands of adhesion between the sclerotic and tendon of the adductor. The same gentleman relates the case of a female, whose cornea bore evident marks of previous long-continued inflammation, on whom he operated for strabismus, and found all the investing structures of the inner periphery of the eye so "thickened, contracted, and infiltrated, that they cut like cartilage," and in a lady who had been twice couched for cataract, and suffered from severe inflammation of the eye after each operation, there was a considerable increase of the strabismus with which she was previously affected, and a greater limitation of the movements of the eyeball. On subsequently operating on her for the strabismus, Mr. Duffin found the same adhesions of muscular, tendinous, and cellular tissue in this case as in the former. To the non-recognition of these adhesions must be ascribed the occasional failure of the operation to rectify the deformity, notwithstanding the internal rectus has been completely divided.

There is a class of strabismic cases which I

have included in the second division of Table II, although they might, with equal and perhaps more propriety, have been placed in the first division. In these cases, the deformity is the result of inflammation of the eye; but only indirectly, and various defects of sight may likewise give rise to it: these indeed are the *exciting causes* of the distortion, the *immediate cause* being reflex contraction of the abductor or adductor muscle, in order to place the eye in the most advantageous position for use. (See Cases 8, 9, 36, and 40.) These are the cases in which the sight is not restored by the removal of the squint: for the former was impaired antecedent to the deformity, and the latter is not the cause of the impaired vision, as it is in ordinary cases; but the impaired vision precedes and produces the deformity.

#### *Of Strabismus of muscular or hypertrophic origin*

I have ventured to attribute to a muscular origin, that large group of cases which cannot be traced to any nervous or inflammatory source and which, from their coming on after violent c

frequently repeated efforts of a particular muscle, may be presumed to be due to some change which the muscle has undergone in its nutrition, and which has thus rendered it more powerful than its antagonist.

A little boy imitates another who squints, he is probably not content with doing so once or twice, but, either to amuse himself or his companions, or to tease the victim of his sport, he repeats it over and over again on various occasions. The internal rectus being thus more frequently and powerfully brought into action than the other ocular muscles, would gradually acquire increased strength, and become relatively more powerful than its antagonist the external rectus. That a muscle thus altered would be very likely to cause distortion, may be inferred from the following facts: 1. In paralysis of the internal rectus there is always some eversion of the eye, produced by the unparalysed external rectus. 2. In like manner when the latter muscle is paralysed, there is some inversion: now a paralysed muscle stands in an analogous relation to a healthy antagonist, as does the latter to an

hypertrophied one : in both cases there is a loss of balance of power, or a preponderance of it of one muscle over the other, which would, on simple mechanical principles, cause the approximation of a moveable body towards the stronger power ; one then of two results must ensue, either the more powerful muscle will draw the eye somewhat towards it, or its weaker antagonist will counteract this by increasing its tension, and this cannot be effected without causing some inversion of the opposite eye :—hence the frequent difficulty of determining the really squinting organ, for the patient being generally conscious which is the bad eye, his volition is directed to it to keep it straight, and this produces inversion of the opposite. The predominance of power of certain muscles over their antagonists is seen in the healthy body, and causes a prevalence of certain positions, as the bent position of the fingers, and the everted position of the leg and thigh in progression, which results from the greater strength of the flexors of the former and the external rotators of the latter. Particular trades impress their stamp on the individuals exercising



them, so that by the mere bearing of a man we may make a pretty shrewd guess as to his avocation or calling.

Simple hypertrophy of the internal rectus muscle, without structural shortening, provided its antagonist is healthy, will not prevent the full eversion of the eye, any more than does the predominance of power of the flexors of the fingers over the extensors, prevent their extension. Hence the explanation of those cases in which the full power of eversion still exists. Want of power to evert the eye to the full extent therefore, is evidence either of shortening of the internal rectus, or of partial paralysis of the external.

But a difficulty occurs in the explanation we have offered of the production of hypertrophy and consequent strabismus, which must now be met. In the normal condition of association of the eyes, it is impossible to turn one eye inwards without also inverting or everting the opposite; therefore, on the hypothesis of this frequent and powerful contraction causing hypertrophy of the adductor, either both muscles should be involved, and double convergent strabismus be produced,

or there should be convergent squint of one eye and divergent of the other, a case that has never yet been seen. If I might hazard an explanation it would be this, namely, that the hypertrophy takes place only in that muscle towards which volition is specially directed, and not in that which sympathetically acts with it. Thus, on looking at a spot on the right side of the nose, the right adductor contracts volitionally and actively, but the left only automatically and passively; the right, therefore, would be the one whose nutrition would be augmented, while that of its fellow would undergo no change. If, on the contrary, we suppose both adductors to contract actively, as in looking at very near objects, or in trying to squint, then both might undergo some increase in their nutrition, become hypertrophied, and double strabismus result. And here I must pause to inquire what is meant by single and double strabismus, for upon no question has there been a greater difference of opinion, than whether, in the majority of cases, the deformity should be regarded as confined to one eye or as affecting both. Lucas affirms that convergent strabismus of one eye is that which is most frequently met.

with. Walton holds the same opinion. "Internal squint, he observes, may affect both eyes; but so seldom, that the occurrence is the rare exception;" and again, "of double strabismus I have seen but few examples." Dixon likewise takes the same view. "Double internal strabismus, he says, rarely exists; in most of the cases which at first sight appear to be of this nature, it will be found on careful examination that the inversion is alternating; first one eyeball and then the other being directed to the object." Elliot, in a very able and interesting paper published in the fifty-fifth volume of the 'Edinburgh Medical and Surgical Journal,' inferred, from the phenomena of strabismus, that the distortion "could not be regarded as confined to one eye, since, when the sound eye was closed, the affected one became straight and could move in any direction; but on raising the lid of the former it was found inverted, though the position of the eyes was soon reversed again." Mackenzie, who adopts these views of Elliot, observes, "Authors speak of single and double strabismus. To constitute a case of single strabismus the distortion, whether convergent or divergent, should always

appear in the same eye and not affect the good eye, even on shading it with the hand; while the squinting eye is directed straight towards objects. Such a case rarely if ever occurs." Critchett, in a paper published in the 'Lancet,' of May 12th, 1857, affirms that "in almost every case (of strabismus) both eyes are equally implicated in the abnormal position."

This want of accordance among writers of such repute, I believe to be more apparent than real. There can be little doubt that every squint, which is not paralytic, is double, in the sense in which that term is made use of by Elliot and Mackenzie, viz., as regards the phenomena manifested; but as respects the lesion by which these are occasioned, this may be confined to one eye or affect both. The information which we derive from the history of strabismus leads to the belief that the greater number of cases are at their commencement single, that is to say the lesion in which they originated was confined to one eye; but as the eyes are not independent of each other's movements, but are associated for the perfection of their function, it follows that any interference with the movements of one must

necessarily disturb the harmonious action of both ; so that even in the paralytic form of strabismus the good eye *appears* to squint, whenever the patient regards an object situated beyond the point to which the axis of the paralytic eye can be directed. In ordinary strabismus the good eye *actually does squint*, whenever the axis of the bad eye is brought to bear on an object ; thus it happens that a squint, though structurally single, is always functionally double, and this functional implication of the sound eye, may lead to its becoming likewise structurally affected. This is one mode in which double strabismus may arise ; but it may be double from the beginning, as it probably is in some of those cases of hypertrophic strabismus which come on from imitation ; in some cases of nervous strabismus, the history also has pointed unequivocally to the double origin of the affection, although the convergence of both eyes was not of that marked character which would determine most surgeons to designate it double. In truth, the difference between single and double strabismus, as ordinarily understood, is merely one of degree, if the mutual convergence of the eyes is slight

and only observed during reverie, while at other times there is merely inversion of one eye, the case is called single; if, on the contrary, the mutual convergence of the eyes is great, and affects the individual at other times than during reverie, the case is said to be double. The difference depends upon the degree in which the adductor muscle of what is usually called the sound eye is implicated; if but slightly, it will interfere but little with its vision, and this will occasion its being more frequently used, and consequently less seldom inverted than the other; if more considerably, the mutual convergence will be greater, and the tendency to use one eye only less; if both adductors are equally affected, two results may ensue; if slightly, the strabismus will be alternating and the vision of each eye equally good; if considerably, the strabismus will be double, the mutual convergence great, and both eyes equally imperfect, necessitating the employment of strong convex lenses. This equal implication of the adductors of both eyes, is however so rare, that I have met with but few examples. In the present collection of cases two only are really of this description, namely, Cases 20 and

25; in all the others, the two eyes were unequally implicated, and of this inequality all degrees were met with, from the greatest disparity, as in Case 5, to the least, as in Case 30. Is it now always possible to determine whether both adductors are structurally affected, or to diagnose a case of this description from one in which the structural change is confined to the adductor muscle of one eye, while that of the other is only functionally implicated? I am bound to acknowledge my inability to do so. At the same time I do not think that this is, practically, a matter of any consequence, as by following the directions laid down in the chapter on treatment, we may always judge of the expediency of performing a double operation.

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### *Of Strabismus of uncertain origin.*

Of the 378 cases of strabismus whose origin I have tabulated in this chapter, 83, or about 22 per cent. were of uncertain origin; either from the cause not having been noted when the case was taken, or from the patient not having known



when the distortion commenced; or lastly, because, though the access of the squint was recollected, the patient could not account for its occurrence. It is the latter description of cases only that calls for remark; can these be referred to either of the three divisions in which the causes of strabismus are grouped? Reasoning by exclusion, we should say they must be of nervous origin, though it would be difficult to prove this. There is a class of affections which somewhat resembles this form of strabismus, and which might throw some light on it, were not their own pathology equally obscure. I allude to those contractions of the fingers which come on spontaneously and gradually, without being preceded by any local paralysis or inflammation, or any appreciable lesion of the nervous centres, nerves, or muscles. The following case will illustrate these affections.

Henry E—, æt. 71, a hearty old man, who has always enjoyed good health, was thrown off a coach twenty years ago, and injured his right shoulder. He could not move it for three months, though it had been neither fractured nor dislocated. About eight months after the accident,



the ring finger of the same limb began to contract, and the contraction has gone on increasing till the present time, when it is in contact with the palm of the hand and cannot be extended. About twelve months ago, the middle finger of the left-hand began to contract in a similar manner, as did likewise the middle toe of the right foot.

It may, perhaps, be thought that these contractions resulted from some injury done to the nerves of the right arm by the fall, and I will not dispute that such might have happened; but it is difficult to associate the subsequent contractions with the injury.

In the following case it will be seen that the contractions took place without any preceding injury or disease.

Jane H—, æt. 50, a healthy looking female, who has enjoyed good health, and never had any fit or suffered from rheumatism, has a contraction of the ring and little fingers of the left hand: the former is bent into the palm of the hand, and there fixed by the flexor tendons and fascia. The other is less flexed; but is gradually becoming

more so. This deformity commenced six or seven years ago, without obvious cause, and has slowly increased to the present date. At first she was able to straighten the fingers, both actively and passively; but latterly she has been unable to do so.

Leaving these obscure cases for future investigation, the facts and arguments which I have brought forward to illustrate the pathology of strabismus, warrant us in drawing the following deductions:

1st. The most frequent *exciting cause* of strabismus, is some lesion of the nervous centres or nerves; and next in frequency are inflammatory affections of the eyes.

2dly. The *essential or immediate cause* of confirmed non-paralytic strabismus is a shortening, with or without hypertrophy, or simple hypertrophy, of the orbital muscle in the direction of which the eye is drawn.

3dly. These muscular changes may be associated with thickening and contraction of the conjunctiva and subconjunctival tissue, and an adhesion of these to the sclerotic coat of the eye.

4thly. The above-named changes may affect both eyes, though they are more commonly confined to one eye—in the former case, “it is immaterial which eye is operated on;” in the latter it is not immaterial, but, on the contrary, essential that the affected eye should be distinguished and selected for the operation.

5thly. The imperfect vision of the strabismic eye may either precede and be the cause of the distortion, or may follow and be the consequence of it. In the former case, the operation of dividing the affected muscle will not remove the imperfection of sight; in the latter it will.

6thly. The morbid changes referred to in deductions 2 and 3 are competent to explain all the phenomena of strabismus.

7thly. The phenomena of strabismus cannot be accounted for on any other hypothesis.

## CHAPTER III.

### ON THE TREATMENT OF STRABISMUS.

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IF the view I have taken of the pathology of strabismus be correct, it must be obvious that no treatment can be of any avail in confirmed squint, except division of the shortened muscle. There must, however, be a stage of contraction antecedent to that of structural shortening, in which medical treatment is called for, and is, moreover, sometimes successful in removing the deformity. Into the consideration of this I do not propose to enter; but shall confine my remarks to the surgical treatment of permanent strabismus.

The operation for the cure of strabismus, is apparently so simple and easy of performance, that nearly every surgeon thinks himself competent to undertake it, and the result is a large number of failures. This has unfortunately brought a very useful and beautiful operation

into discredit, so that, even among my medical brethren, I have heard it stigmatised as uncertain ; and a patient, not long ago, informed me that his medical adviser in the country hesitated in recommending it on these grounds, and declared that the question of operation or no operation in strabismus was one still *sub judice*. Now I am prepared to maintain that there are few, if any, operations so entirely unobjectional and successful as the one in question, and, when properly performed, there is no case of strabismus that may not be improved, and but few that may not be completely cured by it. Several circumstances, to which allusion will be made hereafter, may contribute to render one operation less perfect than another ; but complete failure can only arise from its being imperfectly done. To avoid such a result, I will proceed to consider, 1st, the kind of operation to be selected ; 2dly, the mode of performing it ; and, 3dly, whether it should be done on one or on both eyes. With reference to the kind of operation, I presume few surgeons of the present day will question the superiority of the principle, if not of the method, of subconjunctival division of the muscle in strabismus. This improvement,

I believe, is due to M. Guérin, in France; but its adoption in this country is comparatively recent. In 1845, my friend and colleague, Mr. Charles Brooke, wrote a paper on the subject, in which the defects inseparable from the ordinary method of operating were portrayed, and the subconjunctival section proposed as a remedy; but his little essay did not receive the attention it deserved. From that time till the publication of my lectures on strabismus in 1854, the operation had been scarcely noticed by any English writers, except for the purpose of condemnation. In that work I ventured for the first time to draw the attention of the profession to its merits, and pointed out its advantages in the following terms: "In the first place the small puncture made by the seissors is entirely covered by the lower eyelid, so that not only is there no breach of continuity visible in the conjunctiva, but all air is excluded from the wound, and thus the accession of inflammation is prevented. Secondly, the relations of the conjunctiva to the eyeball and the eyelids being undisturbed by the operation, the symmetry of the two eyes is preserved, and the *plica semilunaris* and *caruncle* maintain

their normal position. Lastly, it is followed by less protrusion of the eye than results from the ordinary method of dividing the musele." In advocating the subconjunctival section of the muscle in strabismus, I do so on the ground of its general merits, and not with the view of excluding other modes of operating where such may be desirable; all I contend for is that this mode of dividing the musele, when properly done and in suitable cases, is superior in its results to that which is ordinarily performed. There are cases, however, in which the ordinary operation is to be preferred to the subconjunctival one; those namely, in which the eye is either immovably fixed in the outer or inner canthus, or in which its lateral movements are so limited that it cannot be brought beyond the centre of the orbit. In all such cases, the mere division of the shortened musele is not sufficient, and the conjunctiva and subconjunctival fasciæ require to be freely divided, and even dissected somewhat from the sclerotic before the eye can be brought into a central position. (See Case 4.) In Case 24 a strong fibrous band was found, closely united to the sclerotic, beyond the vertical axis of the



eye, and required division before the organ could be made to remain in the centre of the orbit; and in a case of congenital paralysis of the third pair of nerves, which was lately sent me by my friend Mr. White Cooper, numerous short, strong bands, situated likewise behind the vertical axis of the eye, retained the organ in its everted position, after the abductor muscle and conjunctiva had been freely divided, and the expedient of fixing the eye in the centre, by a ligature passed around the sclerotic extremity of the cut muscle, had failed. I am satisfied from these two cases, and some others that have fallen under my notice, in which surgeons, well skilled in ophthalmic operations, have divided the adductor muscle of each eye and yet failed to remove the deformity for which the operation was undertaken, that such cases are of more frequent occurrence than is commonly believed. In divergent squint, it is of little consequence which operation be performed; the advantage of the subconjunctival one being limited to the prevention of the ordinary fungus which springs from the sclerotic, when this membrane is laid bare; but in all cases in which both eyes are operated on, whether for convergent



or divergent squint, I think it essential that the division of the muscle should be done subconjunctivally, owing to the risk of converting the squint into one in an opposite direction, if the conjunctiva be freely divided. There are different modes of performing this subconjunctival section of the muscle; I use for the purpose a knife somewhat like a small, straight bistoury, its blade is about an inch in length, has a straight cutting edge, and is inclined to the handle at an angle of about  $150^{\circ}$ ; this facilitates its introduction beneath the muscle, and approximates it to the form, as indeed it subserves the purposes of, the blunt hook.

If the right adductor muscle is to be divided, I make the division from above; if the left, from below. The operation is thus performed. The eyelids being held apart by the spring speculum, and the eye drawn from its unnatural position, a small incision must be made with a probe-pointed pair of scissors through the conjunctiva and ocular fascia *down to the sclerotic*; this should be made three or four lines internal to the cornea, a little above or below a line parallel with its upper or lower border, according as it is elected to divide

the muscle from above or from below. Into the aperture made by the scissors, the knife is introduced and passed underneath the muscle; its back must then be turned to the sclerotic, and its sharp edge towards the tendon of the rectus, which quickly yields to the slightest sawing movement, and frequently with a very audible crack. Before withdrawing the instrument, the sclerotic should be swept with it up to the cornea, to make sure that no fibres of the muscle have been left undivided.

Mr. Critchett, in the 'Lancet,' of May, 1855, has recommended another mode of performing the subconjunctival section, which differs from that just described in scissors being employed instead of the knife, and in the larger aperture which is thus made in the conjunctiva. Mr. Walton objects to all modes of operating subconjunctivally, on the ground of the uncertainty of completely dividing the muscle by this method; and there can be no question, as I have elsewhere stated, that this operation is more difficult to perform than the ordinary one, and requires much practice on the dead body before it should be attempted on the living. In reference to the

old or ordinary operation, it differs from those just described, in the greater extent to which the conjunctiva is divided. The eye being fixed, the operator with a pair of scissors makes an incision of the conjunctiva in the same situation and to an equal extent as in the former case; a blunt hook being now passed through the aperture is directed beneath the muscle, and the eye is thus drawn outwards and held steady by this instrument in the left hand of the operator, while, with the scissors in the right, he divides the muscle and all the structures in front and behind it down to the sclerotic. Where the knife is employed instead of the scissors, a grooved director is passed through the aperture in the conjunctiva beneath the muscle, till its point is on a level with the highest part of the cornea. A sharp-pointed, small, and slightly curved bistoury, guided by the director, is now made to cut its way outwards, dividing in its passage all the intervening structures. Whichever of these methods of operating be adopted, it is desirable that the cut edges of the conjunctiva should be brought into apposition with each other on the completion of the section; but as it is not always

possible so to retain them without some mechanical appliance, Mr. Walton has lately adopted the plan of using ligatures for this purpose, and he speaks highly of the results. In reference to whether the operation should be done on both eyes or only on one, the difficulty is to determine, beforehand, whether both are implicated sufficiently to call for a double operation. In well-marked cases of double strabismus—those, namely, in which a considerable amount of mutual convergence is always present, and in which the inverting power of each eye greatly exceeds the normal limits, while the everting power is diminished—there can be no doubt of the propriety of operating on both, and it should be done at one sitting and under chloroform; but it has been shown in the preceding chapter, that the difference between single and double strabismus, as those terms are ordinarily understood, is merely one of degree, and hence cases are continually met with on the confines of these two states, which cannot be said to belong unequivocally to either, and which an operation can alone decide. The best rule to follow in these doubtful cases, is to operate on the worse.

eye first, previously acquainting our patient of the possibility of a second operation being required on the other eye; then, if ehloroform have not been used, we can at once, on completing the section of the muscle in one eye, determine whether it is necessary to repeat it on the other, the rule laid down by Elliot being that which should be followed; namely, to divide the second adductor if any inversion remain in either eye after division of the first. If, however, chlo-roform have been given, we lose the advantage of ascertaining the exact effect of the operation on the eyes till this anæsthetic has been recovered from, and should an operation on the second eye be required, it must be done at a subsequent period. In recommending the adoption of this rule, it is of course assumed that the inversion which may remain after the operation, is not due to any portion of the adductor musele having been left undivided; and to be assured of this, a careful search with the blunt hook must be made, keeping it close to the sclerotic, and sweeping this tunic with it up to the margin of the cornea. As a means of diagnosing whether the inversion is owing to a portion of musele or fascia being

left undivided, or to a participation of the other eye in the deformity, the vision of the eye operated on should be examined, then if the inversion which remains is caused by the operation having been imperfectly performed, the vision will be found in the same state as it was before; if, on the contrary, the muscle has been completely divided, and the inversion is owing to a participation of the other eye in the deformity, the sight will have undergone marked improvement. (For an explanation of this, see the chapter on Strabismic Vision.) In the latter case, should the remaining inversion be very slight, it may generally be overcome without an operation on the second eye, by what Mr. Elliot has called side-practice, which consists in frequently exercising both eyes in looking sideways, towards the side that has not been operated on; this is done with the object of overcoming the inverting tendency of the sound eye, and where the individuals are sufficiently intelligent, and persevering in their efforts to carry out one's directions in this respect, success is the usual result. In some cases of slight double strabismus, as also when the disposition of the squint to alternate is strongly

marked, a difficulty is experienced in determining which eye ought to be operated on, for although I have already stated that the worse eye should be chosen, it is by no means easy, without the application of some test, to know which is the worse eye ; or, in other words, to distinguish between that which is primarily and structurally affected, and that which is secondarily and often only functionally involved. Here, then, some reliable means of diagnosis is required, and this is to be found in the condition of vision, which is nearly always imperfect in the worse eye ; (and the causes of which fact will be found detailed in the chapter on Strabismic Vision) if however no difference should be discovered in the power of either, it is immaterial which is selected for operation. Mr. Walton, in a letter published in the 'Medical Times and Gazette,' of October, 1856, has called in question the value of this test, and vaunts one which he has proposed as superior ; but I have had occasion already, in several parts of this work, to point out its shortcomings, and shall therefore now merely refer my readers to Cases 11, 23, and 24, where its failure was too patent not to be noted. The



objection which Mr. Walton urges to the adoption of the vision test, rests on a solitary case of strabismus, in which, he says, he satisfied himself that the worse-seeing eye was the one that did not squint. Having replied to Mr. Walton's objections elsewhere (see 'Medical Times and Gazette,' October 18th, 1856), I shall here merely refer my readers to that paper. Since its publication, however, I have met with a case, No. 5, in which the squinting eye had the better vision; but it was one of single strabismus of the left eye which had no disposition to shift to the opposite one, and in which therefore, no test was required; still the fact that the vision of the squinting eye may be better than that of its fellow which is unaffected, is so important as well as rare, as to call for some explanation; and this will be found in calling to mind the effect of strabismus on the vision of a healthy eye—it renders it, as we shall see in the chapter on Strabismic Vision, presbyopic; now the gentleman who was the subject of the deformity was, and had been for many years, myopic, and the occurrence of strabismus in one eye, had so far altered its refractive condition, as to counteract



the original myopia and so improve its vision ; while the other eye, which was free from the deformity, remained myopic as before.

From what has just been stated relative to the necessity of correctly diagnosing the most faulty organ, it will be gathered that I attach some importance to its detection ; and such is the fact, *because on the selection of the eye to be operated on will oftentimes depend the necessity or otherwise of a second operation.* This would seem to be the place for examining the opinions of Mr. Critchett, viz., that in nearly all cases of strabismus both eyes are equally implicated, and it is immaterial which is operated on. Now were the first part of this statement true the second would be necessarily so, for it is a mere corollary to the first ; but the facts and arguments which I have brought forward on the pathology of strabismus, based as they are on the history, morbid anatomy, and phenomena of this affection, and supported by the collateral evidence furnished by orthopædic experience, completely negative such an hypothesis, and prove the reverse to be the truth : had this gentleman affirmed that both eyes are implicated in the abnormal position, he would have

stated what is strictly correct ; but when he says they are equally so, he mistakes the exception for the rule—the rule being that they are unequally affected, both as regards the deformity and the vision ; the exception—the rare exception—being the reverse. Now if this be so, it surely cannot be immaterial which eye is operated on. There are, however, circumstances in which this dogma may be true ; as it indeed is, in those few exceptional cases in which the eyes *are* equally implicated, and in which the vision of each eye is alike. It may also be a matter of no great moment which eye is operated on, in those rare cases in which the really strabismic organ is habitually straight, and the other inverted ; as happens when the vision of the latter is from any cause so imperfect as to render it useless for any available purpose. In such a case, the imperfection of vision acts as the hand placed before the good eye in ordinary strabismus, namely, it throws it into distortion, while the really and otherwise squinting eye becomes straight. (See cases by Mr. C. R. Hall, in the ‘Medical Gazette,’ for the year 1841.) With these exceptions then, I hold that it is material to select that eye

for operation which is *most* implicated in the abnormal position.

I must now direct attention to certain circumstances which influence in some measure the success of an operation. Let us suppose that in every case the proper eye is selected, and the best operation for the particular case undertaken and properly performed, still it does not follow that the ultimate result will be equally good in all. Some cases are so perfect that it would require the closest scrutiny of an anatomist or an artist to detect the eye which had been operated on; and from this standard there are various degrees of imperfection, many of them still too slight to be observed by any one but an artist; but some of them sufficiently evident to give to the eye a peculiarity of expression which is not shared by its fellow, albeit a great improvement on the original deformity. Now these imperfections may exist totally irrespective of any fault in the operation, and are in fact a part of the original deformity, which the operation in question is not competent to remedy. Were all cases of strabismus exactly alike, then, if the operation were properly done, undoubtedly we ought to have

uniformity of result; but in truth there is as much variety of deformity as there is of perfection; there is a general resemblance, but an individual difference; and it is the latter which regulates the result. If the eyes of healthy individuals be observed, it will be found that slight deviations in their apparent bulk are not unfrequent, and one eye may appear a little too small or a little too large, according as one or the other is regarded as the normal standard of size. Now precisely the same condition of things may be associated with strabismus, though the latter being the greater deformity masks the former and lesser. Should now an operation be undertaken for the cure of the obliquity, the amount of success will depend on whether this obliquity affected the eye that was apparently too large or the opposite one; for the tendency of the operation being to increase slightly the apparent bulk of the eye, if this was previously on the side of excess it will render it more apparent; if, on the contrary, the obliquity affected the apparently smaller eye, the operation will remedy both defects, and a perfect result will be the consequence.

In some of these unequally prominent eyes

the inequality appears to be due to an actual difference in the bulk of the two eyeballs, at least so I infer from the cornea being of unequal size; in others, again, the size is alike, but one eye is really more prominent than the other, being affected with a slight amount of proptosis: most frequently, however, the variations in the bulk or prominence of the eyes are more apparent than real, and depend on the different size of the palpebral aperture. I have observed a few cases in which the *form* of this aperture varied in each eye—the distance between the lids at the inner canthus being greater in one eye than in the other, while no such difference affected the same parts at the outer canthus. All these deviations from the normal type, necessarily affect the result of an operation, and are not unfrequently, though erroneously, attributed to it. Again, in the paralytic form of strabismus, the same amount of success cannot be obtained as in the ordinary varieties of that affection; but it would be very unfair as well as absurd to attribute this to any defect in the operation—the latter effects all that is possible or capable of being done by operative means—it rectifies the

malposition of the eye and improves its vision, but it cannot cure the paralysis. There is one circumstance which would render any operation for the removal of strabismus improper; namely, when it enables the patient to see better than he would do were his eye undistorted. In such a case the personal appearance becomes of secondary consideration, and must yield to the more important behests of vision.

In conclusion, I must repeat my conviction that there is no operation in the whole range of surgery, which is so entirely unobjectional and free from risk; complete failure can only arise from its imperfect performance, while improvement may be predicated in every case, and perfect success in most.

## CHAPTER IV.

### ON PARALYTIC AFFECTIONS OF THE EYE.

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THE muscles of the eye derive their nervous supply from the third, fourth, and sixth cerebral nerves, and the first of these supplies likewise the iris. Disease, therefore, affecting these nerves in any part of their course, occasions paralysis of the muscles to which they are distributed, and in the case of the third and sixth nerves, distortion of the eyeball, as may be seen in sections I and II of the first chapter; but paralysis may exist without causing distortion, as when two antagonist muscles are both paralysed, as the superior and inferior, or the internal and external recti. (See Case 43.) Or again, one of these muscles may be affected in so slight a degree, that its healthy antagonist scarcely produces any sensible deviation in the position of the eyeball, as was seen in Case 31. Hence



these cases, though not very uncommon, are apt to be either overlooked or misunderstood, and several instances have come to my knowledge in which patients so affected have been treated for diseases of altogether a different nature. This is not unlikely to happen in certain affections of the third nerve, as we have already witnessed in Case 31; for the pupil being dilated and fixed, the vision impaired, and the eye undistorted, the symptoms are attributed to disease of the retina, optic nerve, or brain, and the patient is supposed to be affected with amaurosis. It seems to me, therefore, that a few remarks on the nature of the impaired vision which accompanies paralytic and spasmodic affections of the muscles of the eye, together with the means of diagnosing them from amaurotic affections, may not be out of place; and I shall treat first, of the impaired vision which accompanies paralysis, while in the succeeding chapter strabismic vision will be treated of.

The subjective symptoms which are most frequently observed in paralysis of the ocular muscles are the following:

There is mistiness of vision, so that all objects



appear to be enveloped in a fog ; they also appear more illuminated and somewhat diminished in size ; distant objects are seen better than near ones, for the eye is presbyopic, and its focusing power is lost or greatly diminished. There is, also, not unfrequently intolerance of light, especially if the pupil be much dilated, and the vision is greatly improved or altogether restored by a convex lens. If now these symptoms be compared with those of incipient amaurosis, the following differences may be noted. In the latter disease there is mistiness of vision ; but the objects appear less illuminated than they do to the sound eye, and a strong light not only produces no photophobia, but is absolutely necessary in order to enable the patient to see ; there is no presbyopia nor is there myopia ; but distant objects cannot be seen at all and near ones only indistinctly : a convex lens improves the sight, as we saw it did in paralysis of the ocular muscles ; but in the latter affection it acts by correcting the too little refraction of the eye, in the former by magnifying the objects. Then again, in amaurosis there is not unfrequently partial vision, so that objects are only partly seen, or require to

be held in certain positions in order to be distinguished—or there may be coloured vision, or *muscæ volitantes*, or pain and aching in the eye. These symptoms then, together with the absence of paralysis of any of the orbital muscles, are sufficient to distinguish amaurotic from muscular imperfections of sight. The real source of error in the diagnosis of the latter, lies in a too exclusive attention to the impaired vision and dilated pupil, whilst the movements of the eyeball are not examined, and the paralysis of its muscles is thus overlooked. With regard to the nature of the impaired vision, consequent on paralysis of the muscles of the eye, I may observe, that the perfection of this organ, as an optical instrument, depends not only on the integrity of its several individual parts; but on the existence of a similar normal condition of all those structures which are accessory to it. The nerves and muscles of the eyeball are among the most important of these structures, and they exercise an influence over vision, which is perhaps not sufficiently appreciated; indeed it may be laid down as an axiom, that the healthy condition of the ocular muscles is necessary for perfect vision. Of the

truth of this statement, we have had abundant evidence in the cases illustrating the different varieties of strabismus. If, then, the balance of power of these muscles is disturbed, either by excessive or diminished action of one or more of them, the eyeball into which they are implanted is no longer in its normal condition, it must be either too much, or too little, or irregularly pressed upon, its form thereby altered and the refracting power of its contents interfered with. It has been asserted that the impaired vision which accompanies paralysis of the third nerve, is due to the attendant dilatation of the pupil; but if this were the case, the sight should be good in those forms of paralysis of the ocular muscles in which the pupil is not dilated, which is contrary to the fact, as may be seen by a reference to Case 1 (paralysis of the sixth nerve), so that in cases of paralysis with enlarged pupil, there is most probably a defect of sight due to the paralysis of the ocular muscles, and independent of the influence of the altered condition of the pupil; in other words, the dilated pupil acts but as a part of the cause and is not the sole cause

of the defect. The following cases will serve to illustrate the foregoing observations.

CASE 41.—*Paralysis of the third pair of cerebral nerves.*—“I was consulted in the beginning of 1809,” observes Dr. Wells, “upon a disease of vision which, as far as I know, has not hitherto been mentioned by any author. The subject of it was a gentleman, about thirty-five years old, very tall, and inclining to be corpulent. About a month before I saw him he had been attacked with a catarrh, and, as this was leaving him, he was attacked with a slight stupor and a feeling of weight in his forehead. He began at the same time to see less distinctly than formerly with his right eye, and to lose the power of moving its upper lid. The pupil of the same eye was now also observed to be much dilated. In a few days the left eye became similarly affected with the right, but in a less degree. Such was the account of the case which I received from the patient himself, and from the surgeon who attended him. The former added that, previously to his present ailment, his sight had always been so good, and that he had never

used glasses of any kind to improve it. On examining his eyes myself, I could not discern in them any other appearance of disease than that their pupils, the right particularly, were much too large, and that their size was little affected by the quantity of light which passed through them. At first I thought that their dilatation was occasioned by a defect of sensibility in the retina; but I was quickly obliged to abandon this opinion, as the patient assured me that his sensation of light was as strong as it had ever been during any former period of his life. I next inquired whether objects at different distances appeared to him equally distinct. He answered that he saw distant objects accurately, and in proof told me what the hour was by a remote public clock; but he added that the letters of a book seemed to him so confused that it was with difficulty he could make out the words which they composed. He was now desired to look at the page of a printed book through spectacles with convex glasses. He did so, and found that he could read it with ease. From these circumstances, it was very plain that this gentleman, at the same time that his pupils had become

dilated and his upper lids paralytic, had acquired the sight of an old man, by losing suddenly the command of the muscles by which the eye is enabled to see near objects distinctly."

A similar defect of sight is produced by belladonna, of which the following is an interesting example :

CASE 42.—A respectable female, thirty-five years of age, presented herself at the South London Ophthalmic Hospital in great distress about her sight, which, for the last week or ten days, she said had been gradually getting worse and worse, and she much feared she was going blind. There were no marks of inflammation about the eyes, but both pupils were widely dilated, and motionless under variations of light ; besides this, no other abnormal appearance was observed, and the movements of both eyes were perfect. The vision was, however, very much impaired ; she could not make out a word of the largest type in the title-page of a book, and everybody and thing seemed enveloped in a thick mist. I placed a pair of convex glasses before her eyes, and to her great delight the mist was

dispersed and she saw perfectly. On inquiring into the history of the case, I found she had been suffering from neuralgia, and was then under treatment for it; and she produced from her pocket a prescription, which, unfortunately, I did not copy; but the active ingredient prescribed was belladonna, in doses of the third of a grain, three times a day. I need scarcely add that the patient's sight was restored by simple abstinence from the drug which had produced the defect of vision.

The following instructive case of paralysis of all the muscles of the right eye, of syphilitic origin, first came under my notice while engaged in assisting Dr. Frederiek Farre in seeing the out-patients at St. Bartholomew's Hospital.

CASE 43.—William S—, æt. 30, applied at the out-patient room, on the 20th of August, 1839, complaining of great pain in the head and drowsiness, together with impairment of vision of the right eye, the pupil of which was widely dilated and immovable under variations of light.



His wife says "he does nothing but sleep all day long," and is frequently delirious at night; and that he has been gradually becoming more drowsy and listless for the last six months.

CC ad  $\text{ʒviiij}$  tempori dextro.  
Hyd. c. Cretâ,  
Ext. Conii, aa gr. iiss, bis in die.

30th.—The pain in the head was relieved by the eupping, but his other symptoms continue; and he is now unable to raise the eyelid of the right eye, or to roll it inwards, upwards, downwards, or outwards.

Pt. CC ad  $\text{ʒviiij}$ .  
P. Hyd. gr. v, bis in die.

September 6th.—By some mistake he neither got the medicine nor was eupped. The pupil of the left eye is now somewhat dilated, and its movements sluggish—he complains of weakness of the limbs. The eupping and pills were again ordered.

12th.—He felt relieved by the eupping, so far as regards the headache and drowsiness; but the condition of the right eye remains unaltered.

Pt. Pil.



October 12th.—He ceased to attend as an out-patient after the last note was taken, and I have just learnt that he has been in the Middlesex Hospital for the last month, where he was treated with open blisters to the temple, and put on a mild mercurial treatment. Feeling much better, and being quite free from pain and drowsiness, he yesterday left the hospital of his own accord. He has gained flesh, and is able to raise slightly the lid, so as to leave a narrow chink between it and the lower; but he has still no power to put in motion the other muscles of the orbit, and the pupil is still dilated and immoveable.

October 28th.—He has been living at home and pursuing no treatment since the 12th inst., and he is now worse again. He complains of great pain in the back of the neck, limbs, and sternum, which becomes worse at night, and prevents him sleeping. At the upper part of the sternum is a hard round tumour, very painful on pressure, which has only been observed the last few days. He has some urgency in micturition; the bowels are regular, the appetite good, and the pulse regular, slow, and feeble.

November 17th.—At the beginning of this

month he was admitted into St. Bartholomew's Hospital under the care of Mr. Lawrence, and the same good results followed a similar plan of treatment as had been pursued at the Middlesex. Finding himself again relieved of his more urgent symptoms, he left the hospital. (Mr. Lawrence attributed all the symptoms to a syphilitic origin.)

January 3d, 1840.—The patient was admitted under my care at the St. Paneras Dispensary. The ptosis has nearly disappeared, and the patient is able by an effort to raise the lid to its natural extent; the movements of the eyeball have likewise increased, and the tumour on the sternum has nearly disappeared. The patient now began to suffer from a train of symptoms which I need not here detail; but which seemed to be due to the disease attacking the right humerus and several of the bones of the spine. These also disappeared under a mild mercurial course, followed up by five grain doses of the iodide of potassium in decoction of sarsaparilla taken three times a day; and on the 29th of the same month my notes state that he is getting strong and fat, has a great appetite, and feels well; but the paralysis of the

museles of the eye still remained in the same condition as described on the 3d instant.

April 4th, 1840.—The patient was discharged on the 20th of February, well in all respects but the paralysis, which had not quite been recovered from. He now once more came under my care for periostitis of the left tibia, which yielded to a similar treatment to what had before been of so much service.

February 25th, 1841.—I saw my former patient again to-day; he is now well and pursuing his ordinary business as a painter, but the paralysis is not yet quite recovered from. The eye can be inverted and everted to about an equal extent, but less than natural; its movements upwards and downwards are also about equal, but limited. The pupil continues unnaturally dilated, and is but slightly moveable under variations of light, which renders a bright light very dazzling and causes lachrymation. He can read the “nonpareil” type with either eye; but to the paralysed one the print appears more illuminated, smaller, and misty: a convex glass assists the sight, but does not entirely remove the mistiness. He has no power of adapting the eye to different

distanees, so that if the print be removed nearer or further than the ordinary focal distance of the eye it ceases to be distinguishable. Some confusion of vision exists when both eyes are open, and on looking upwards or downwards when the head is fixed double images are seen; he avoids this, however, by moving the head in the same directions, and while engaged in his work is often obliged to close the bad eye.

CASE 44.—*Partial hemiplegia of the left side.*

*Loss of vision of the right eye, and paralysis of most of the orbital muscles of the same eye.*

James F—, æt. 30, formerly a sailor, was admitted into the Westminster Hospital, under the care of Dr. Kingston, who kindly allowed me to take notes of the case, on the 10th of July, 1849, with the following symptoms.

The left arm and leg are partially paralysed, so that he cannot grasp an object with firmness or raise his hand to his head higher than his mouth, neither can he support his whole weight on the left leg, nor walk without dragging it after him. On putting out his tongue the point is directed strongly to the left side. On talking

or laughing the museles of the right side of the face act more strongly than those of the left, and draw the features to the right side. In addition to these symptoms, the vision of the right eye is lost, and there is paralysis of nearly all the orbital museles of this side, producing ptosis to the extent of concealing the upper half of the cornea, and a fixation of the eyeball nearly midway between the outer and inner canthi, but rather nearer to the former. The only movements which are perceptible in it are a slight rotatory one on its antero-posterior axis when the patient attempts to look downwards, and a very considerable movement backwards on holding up the lid and telling him to shut his eyes. The former movement is produced by the obliquus superior musele, and the latter by the orbicularis. The pupil is intermediate in size between contraction and full dilatation, and does not alter under variations of light:—the common sensation of the eye is perfect—the pupil of the left eye acts but sluggishly.

*History.*—He attributes his malady primarily, to a severe blow which he received on the right side of the head while on board a man-of-war as an A. B. seaman, and has “never been the thing

since," but subject to headaches. Last February he fell into the Thames, and remained in his wet clothes the whole day. A week after this accident his sight began to fail, vision becoming misty, and the mistiness continuing to increase to the present time; but he has had no museæ or flashes of light. The ptosis came on shortly after his sight began to fail, and at first the lid was quite closed; but the next day "the eye opened" to its present dimensions. A fortnight ago, while out walking, he felt his legs becoming very weak, and they got weaker and weaker as he proceeded, till he could go no further. He never had any "fit," and always enjoyed good health till he received the blow on the side of the head just referred to.

July 13th.—The movements of the eyeball and of the eyelids of this patient were again examined. There can be no doubt that the superior oblique muscle has escaped paralysis, and the movements produced by it are well seen. On telling the patient to look downwards, the eye is rolled in its antero-posterior axis from above downwards and inwards; at the same time the upper portion of the globe is drawn slightly

forwards, and the cornea thereby directed, or having an inclination given it, very slightly downwards and outwards. There can be no mistake about this, the same movements always take place whenever the patient makes an effort to look downwards. Winking takes place simultaneously in the two eyes, and the lids of the paralysed eye follow the movements of the sound one when the latter is rolled downwards or upwards, though the paralysed globe remains stationary under these circumstances.

August 3d.—For the last week the upper lid has completely fallen, and cannot be raised from the lower by any effort of volition. The other symptoms have undergone no appreciable change. The patient left the hospital shortly after the date of this note, and subsequently was under the treatment of Mr. Painter, of Brydges Street, Covent Garden, who kindly furnished me with the following further particulars. It appears that shortly after he left the hospital, the ptosis gradually disappeared under the use of Pil. Hydrargyri and blistering, but the flexors of the fingers, wrist, and forearm of the left side



began to contract, and shortly after the corresponding parts of the left lower extremity became similarly affected. The contraction of the former parts went on increasing, till the clenched hand was pressed firmly against the shoulder, and any attempt made to overcome this rigidity was creative of excessive pain, and of no avail. For some time before he died he experienced great difficulty in swallowing, and lost his voice, the immediate cause of his death appearing to be inanition from want of power to take nourishment.

*Examination of the body, twelve hours after death, March 22d, 1850.*—Left arm and leg strongly flexed, body emaciated, face and surface pale. On removing the calvarium, the dura mater exhibited more vascularity than natural. On stripping off this, the blood-vessels on the surface of the brain were seen to be much distended, and a slight want of symmetry was observed on the two sides, arising from a flattening of the anterior half of the right hemisphere. Some little difficulty was experienced in removing the brain from the skull, owing to the adhesion



of the under part of the right middle lobe to the middle fossa of the skull, and of the tuber cinereum and optic commissure to the pituitary fossa and olivary process.

On placing the brain in a plate with the base uppermost, the under part of the right middle lobe was partially broken down, and presented a somewhat gelatinous aspect. The right optic and motor oculi nerves were partially enveloped in a fibrinous deposit which glued them to the bone, and thus occasioned the difficulty which was met with in removing the brain. The motor oculi nerve was decidedly smaller than its fellow of the left side; but no perceptible difference was observed in the fourth or sixth nerves of the two sides. The crus cerebri of the right side, near its junction with the pons, was soft and easily lacerated. On replacing the brain on its base, and removing the hemispheres to a level with the corpus callosum, a marked difference was perceptible in their size, the right being sensibly less than the left. On opening the lateral ventricles, the right corpus striatum was found softened and broken down, and the thalamus atrophied. The left was not softened, but much atrophied, and

the thalamus of that side, where it forms the wall of the third ventricle, was affected with a patch of yellow discoloration about the size of a shilling. No other morbid appearances were observed in the brain, and no other viscera were examined. The skull was thin, but presented no marks of disease.

## CHAPTER V.

### ON CERTAIN FORMS OF IMPAIRED VISION.

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IN the last chapter, I spoke of the impaired vision which accompanies *paralysis* of the ocular muscles, and pointed out how it might be distinguished from amaurotic affections. In the present chapter I shall treat of the impaired vision which results from *excessive action* of the same muscles, and which bears this resemblance to the paralytic form of impaired vision, that it may or may not be accompanied with distortion. In both cases, the rule is that there is distortion, the reverse is the exception; in speaking of this imperfection of sight, therefore, my examples will be drawn from strabismic cases, and I shall afterwards, in section 11, add a few illustrations of this muscular amblyopia unattended with distortion.

## SECTION I.

ON MUSCULAR AMBLYOPIA FROM HYPERTROPHY OR  
SHORTENING OF ONE OF THE RECTI MUSCLES.A. *With distortion (Strabismic Vision).*

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It has long been known that confirmed strabismus is accompanied with some imperfection in the vision of the distorted eye ; but no one, so far as I am aware, has demonstrated the nature of this imperfection. It is believed by many, to be owing to diminished sensibility of the retina from disuse of the distorted organ ; but this hypothesis is clearly untenable, as I proved in my 'Lectures on Strabismus,' published in 1854 ; for, independent of the fact there insisted on, namely, the *immediate* improvement of sight which follows division of the faulty muscle, there are few cases of strabismus in which the squinting eye is not used sufficiently to prevent any diminution of its function from disuse ; and even in

bad cases of luseitas, in which the cornea is almost buried in the inner canthus, more light must be admitted to the retina than in most cases of cataract; yet in the latter disease, we do not find that the retina has become impaired by disuse. A very remarkable case confirmatory of these views is related by my friend, Mr. White Cooper, in his useful little work on 'Sight.'

CASE 45.—“A worthy miller, seventy-six years of age, consulted Mr. Soden, who discovered double lenticular cataract. ‘Well, my man! we’ll do first one eye, and then the other,’ said he. ‘Why, bless ye, sir,’ replied the countryman, ‘you surely be’ant agoing to do anything to my left eye! Why, I’ve been blind o’ that eye ever since I was born, and ’twas found out at my christening.’ Nevertheless, Mr. Soden extracted both cataracts, and the miller had as good sight with the left eye as the right eye. Considering, observes Mr. Cooper, that the retina had not been used for seventy-six years, this is the most remarkable instance I know.”

The imperfection of vision of squinters, therefore, cannot be owing to disuse of the distorted

eye. Mr. Duffin, having observed that the improvement of vision which followed the operation for the removal of strabismus was sudden and not gradual, likewise discarded the doctrine of disuse, and supposed that the imperfection of sight arose, partly from the obliquity preventing the simultaneous use of both eyes, partly from the object not being depicted on that portion of the retina destined to receive visual impressions, and in many instances, "when the eye is bound down by adventitious adhesions, &c., so as materially to limit its movements, there is reason to believe that the optic nerve is exposed to inconvenience, sufficient to induce a really amaurotic condition of the retina." "May it not happen," he continues, "when strabismus is very marked and the eye confined, that the optic nerve suffers inconvenience from being slightly bent on itself." It is evident, from the quotations just given, that Mr. Duffin has made no distinction between the phenomena which are present when both eyes are open, and those which are proper to the squinting eye only. Thus, he thinks, the imperfection may arise in part, from one eye only being used at a time (the nature of the imperfection, there-

fore, being simply that of monocular vision) ; in part, from objects not being depicted on that part of the retina which is destined to receive them ; and, in some cases, from an amaurotic condition of the retina arising from the optic nerve being slightly bent on itself. That, in many cases of strabismus, the squinting eye takes little or no part in ordinary vision, there can be no doubt ; and therefore, so far, such a person must see less perfectly than he would do with both eyes ; but that the impaired sight of a squinting eye is owing to the projection of objects on a wrong part of the retina, or arises from the optic nerve being bent on itself, is disproved by the fact that the impaired vision is observed, not when the eye is distorted, but when it is straight, in a position, therefore, in which objects would be depicted on that part of the retina which is destined to receive them, and in which the optic nerve would not be bent. We must discard, therefore, all these hypotheses, and consider, in the first place, what is the nature of the imperfection we have termed strabismic vision ; and, secondly, what is its cause ?

With regard to the nature of the imperfection,

it must first be clearly understood, that I do not include under the term strabismic vision every kind of imperfect sight which may accompany strabismus; all I maintain is, that there is, in addition to any and every other defect of sight which may co-exist with the deformity, this special one also superadded, into the nature of which I will now inquire. By a reference to the cases illustrating the non-paralytic forms of strabismus it will be seen that the most obvious defect is a want of power to discern small objects, as small print, which cannot be deciphered without the aid of a magnifier. In most, a want of definition prevailed, so that objects appeared misty and indistinct. In some cases they needed to be held very near to the eye, as if it were myopia, and in all, vision was improved by a convex lens, and completely restored by division of one of the recti muscles.

These then, are the symptoms which characterise strabismic vision; symptoms which, however they may vary in intensity, remain essentially the same in kind, and isolate this affection from every other form of impaired vision, which has been hitherto recognised or described. It differs from



myopia in being improved by a convex lens—it differs from presbyopia, in requiring the approximation of objects to the eye—from asthenopia, in being persistent and not intermittent—from limited adjusting power, in the total absence of all power of adjustment—and it differs, lastly, from certain cases of incipient amaurosis, in its being remediable by operation. What now is the nature of the defect? Is it a dioptric or a sentient one?

The symptoms we have described as characteristic of the affection, show that it partakes of the nature of both these defects. In slight cases it would appear to be chiefly, if not entirely, a dioptric defect; in bad cases the sentient part of the eye also would appear to be implicated; and in all, the defective sight, however it may vary in degree, is brought about by abnormal muscular action. That this form of impaired vision is really the effect of undue action of one of the muscles of the eyeball is, I think, capable of demonstration; for, in addition to the fact already insisted on, viz., the *immediate* improvement or restoration of vision which follows division of the muscle which has produced the squint, it will be found

that in all those cases of strabismus where the eyes can be kept parallel, it is evidently the result of considerable effort on the part of the patient; and this muscular exertion to prevent inversion, throws the eye out of focus and prevents or neutralizes the focusing power. The muscular apparatus of adjustment is so delicate, that any act of antagonism on the part of the recti muscles will neutralize it. In support of this position I must refer my readers to Cases 5, 6, and 21, in each of which it will be seen that the vision of the good eye became impaired whenever the patients succeeded in maintaining the two eyes parallel with each other; but the moment the muscular effort ceased, and the bad eye thereby became inverted, perfect vision was immediately restored; so that it might with truth be said, if the eyes were straight the patients could not see, and if they saw, the eyes could not be straight. Now what was observed in the healthy eye, under the circumstances mentioned in these four cases, may always be observed in the strabismic eye when the healthy one is closed; for then the former becomes straight, and as its adductor muscle is shortened or thickened, such an effort is

required to effect this, as not only produces inversion of the sound eye, but subjects the strabismic one to undue pressure, and thus throws it out of focus, and in bad cases perhaps even diminishes the sensibility of the retina.

Again, it will be seen by a reference to Case 4, that previous to the operation which liberated the distorted eye, the vision of its fellow was very imperfect; but no sooner was the position of the former rectified, and thus all *effort* to maintain the good eye in the centre of the orbit removed, than the sight of the latter was restored. But perhaps one of the best examples of the influence of muscular action on vision, is to be found in Case 6, in which, previously to the occurrence of strabismus, both eyes were highly myopic; but afterwards the nearsightedness of the squinting eye was much diminished, and its vision improved. It would appear, therefore, that the slight pressure which must be exerted on the strabismic eye, in an antero-posterior direction, whenever it is straightened, is sufficient to render it slightly presbyopic or to lengthen its focus; hence the improvement of vision in the case just referred to. The following case,

taken from Mr. White Cooper's work on 'Sight,' is in point.

CASE 46.—“ In September, 1852, Mr. A. P—, applied to me for advice. He stated that he was born when his parents were advanced in life, had been a very weakly infant, and having been nearsighted as long as he could remember, his eyes had been used but little. To read at fourteen inches, he required No. 5 ; and No. 7 to see distant objects. He remarked that to distinguish the flagstaff in the practice-ground at Woolwich at 1200 yards, he was obliged to use No 10. But the curious feature in his case was, that by making gentle pressure with two fingers, the one on the upper part of the eye, and the other on the lower (thus altering the antero-posterior diameter) he was enabled to read with perfect facility at twenty-five inches.”

From the foregoing facts, then, it would seem that the *cause* of the impaired vision in strabismus, is the pressure exerted on the eyeball by the internal and external recti muscles ; and that the *nature* of the impairment, depends on the amount of this pressure. If the internal rectus

be but slightly shortened or hypertrophied, but little force will be necessary on the part of its antagonist to straighten the eye, and the organ will merely be submitted to slight pressure in the antero-posterior direction, and its focus thereby lengthened. But if a greater amount of shortening or hypertrophy of the internal rectus exist, a corresponding effort must be made by the external rectus, in order to maintain the straight position of the eye; and the pressure thus exerted is so great as not only to throw it completely out of focus, but possibly to diminish the sensibility of the retina.

This explanation of the impaired vision which accompanies strabismus is substantially the same as that I gave in my 'Lectures.' Mr. Critchet, however, objects to it, on the ground that there is no uniformity of result following the operation for strabismus, as far as regards the vision of the strabismic organ; the improvement of sight, he states, "is sometimes gradual, and sometimes no perceptible change takes place." With reference to the first statement, I am completely at issue with him, never having met with a case where the improvement was gradual; whatever

improvement took place, was evident on the completion of the operation, and there it rested. In this observation it must be clearly understood that I speak of the sight of the strabismic eye only; for it not unfrequently happens, that considerable confusion of vision is at first experienced in using the eyes together. This arises from their altered relation to each other, and gradually passes off as they become accustomed to act together. In this sense, then, viz., speaking of vision with both eyes, the improvement may be said to be gradual. Mr. Critchett's second objection, that "sometimes no perceptible change takes place," I have already anticipated at page 174, but I may here add, that the absence of any perceptible change after the operation, is evidence either of the muscle not having been completely divided, or of the existence of other disease in the eye. If, for instance, the strabismic eye were congenitally imperfect, or were previously affected with cataract or amaurosis, or any other disease seriously implicating its functions, the mere removal of the distortion would not restore its vision; and that the organ is not unfrequently damaged in various degrees by the

same disease as caused the distortion, is a fact beyond dispute. Let us now suppose that strabismus were in one case to seize on an eye whose vision had been previously lost—in another case, on one whose function was but slightly impaired—and in a third, on a perfectly healthy eye: the effect would be inappreciable in the first; it would impair still further the vision in the second, and the sight in the third would cease to be perfect. Now let us suppose further that these three cases are submitted to operation—this would produce no change in the vision of the first patient; it would improve that of the second, and would restore that of the third. Enough, I trust, has been said to prove the groundlessness of Mr. Critchet's objections to the explanation I have offered of the impaired vision of squinters.

## SECTION II.

ON MUSCULAR AMBLYOPIA FROM HYPERTROPHY OR  
CONTRACTION OF ONE OF THE RECTI MUSCLES.

B. *Without distortion (Strabismic Vision).*

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UNDER certain circumstances we meet with this form of impaired vision unaccompanied by distortion, as when an individual affected with strabismus, is from any cause deprived of the sight of his good eye, the formerly squinting one then becomes straight and is brought into use. Its vision does not, however, improve by exercise, as is commonly believed; on the contrary, it remains as imperfect as it was previously to the loss of the good eye, and can only be improved by the division of its adductor muscle; this is a fact to which every ophthalmic surgeon should be fully alive. I was, some time ago, unfortunately witness to a very distressing case of mal-practice, arising out of the non-recognition of



this fact, and which terminated in the entire destruction of the only eye the patient possessed.

CASE 47.—A. C—, forty-five years of age, stout and healthy looking, lost the sight of his left eye three years ago, a small shrunk button on which the lids have collapsed being all that remains of it. The cornea of the right eye is slightly nebulous in the centre, and the pupil is large and perfectly clear. The vision is very imperfect, so that the patient cannot read or even distinguish one person from another, though he can find his way about without assistance. He states that before he lost his left eye, the right was strongly inverted, and he made no use of it; but after the loss it became straight, and he was indebted to it for the small amount of vision which he now possessed. Notwithstanding these circumstances, the surgeon he consulted extracted the lens—it was not cataractous; but had a slightly opaline tint. This was on the 27th of May. On the 3d of June, the eyelids were greatly swollen; on the 19th of the same month the eye was lost.

That the sight of this poor man would have been greatly improved by the harmless operation of dividing his internal rectus muscle, I have little doubt; but the proceeding which was adopted could scarcely have failed to deteriorate the vision, even if it had not been followed by destructive inflammation.

The following case appears to me to be an example of strabismic vision of the right eye without permanent distortion, though it is not improbable, from the high degree of imperfection of sight and the dilated pupil, that some other lesion of the organ also existed. With my present experience of the beneficial effects resulting from division of the internal rectus, in even slight cases of strabismus, I should not hesitate, were I again to see this patient, to recommend its adoption in her case.

CASE 48.—Louisa L—, æt. 13, was brought to me on the 4th of September, 1841, to be operated on for a squint of the right eye; but as it was slight, and not constantly present, I declined operating. The patient had perfect power over the eye,

and could move it in all directions to the same extent as the other. The sight of the eye was very imperfect; neither near nor distant objects could be well seen, and appeared to have no definition. She could not even read "English" type; but only the largest print in the title-page of a book. The sight of the left eye was good; but she was subject to headaches, and when thus affected this eye became asthenopie, and objects then appeared to it as they did constantly to the other.

The mother of this girl stated that she first observed a tendency to squint when her daughter was between two and three years of age, and during meals.

October 8th.—The eyes were again examined to-day, and it is evident that the left is slightly affected with presbyopia, as she is obliged to hold a book beyond the ordinary reading distance in order to read with facility, and if the print be small a convex glass is required. "Nonpareil" type cannot be distinguished without this assistance.

December 5th, 1853.—This patient called on me to-day to consult me for another complaint. Both her eyes are now perfectly parallel, and no

traec of strabismus is apparent ; but she declares that she always experiences a dragging sensation in the right eye towards the inner canthus, especially when she looks outwards with that eye. The pupil is somewhat more dilated than that of the left eye, and its vision remains in the same condition as it was in twelve years ago. The sight of the left eye is still presbyopic and asthenopic, and she cannot do without convex spectacles, which she has worn since she was sixteen years of age.

While these sheets were going through the press, I met with the following well-marked example of strabismic vision without squint.

CASE 49.—William N—, æt. 33, formerly an artificial-flower maker, but now unable to follow this occupation owing to his sight failing him, applied at the South London Ophthalmic Hospital, on the 27th of November, 1857. There is an appearance of weakness about the eyes, which are small, near together, and more convergent than healthy eyes, though the man cannot be said to squint. The everting power of both eyes is feeble, so that he cannot bring the outer margin of the

cornea nearer than a line or a line and a half of the external commissure of the eyelids. The inverting power of the right eye is slightly exaggerated. The cornea and pupils are healthy. *Vision* of each eye is imperfect. With the right, he can barely make out the largest letters in the title page of an octavo ; but a convex lens assists its vision. With the left eye he sees better when the right is closed ; but even then he cannot make out any type smaller than the "pica." When the other eye is open two sizes larger than this cannot be read, owing to what he calls "the *strain* on the eye."

On questioning him on the meaning he attaches to this expression, he says the eyes feel as if dragged inwards when both of them are open, and a great effort is then required to see ; but when the right is closed the dragging sensation and the effort are diminished. (On suddenly opening the right eye, it is seen to be inverted.) Owing to this effort he cannot do any work requiring sustained vision, and reading, of which he was formerly fond, is now both a painful and a slow process, from his being obliged to rest frequently in order to recover his sight, which

disappears temporarily if he attempts to read above ten minutes at a time. He does not recollect having suffered from ophthalmia; but his sight has never been very good, and lately it has been getting worse. He has been under the care of a celebrated oculist, who prescribed medicines and lotions, but without benefit.

The asthenopia, which was present in the last two cases, is a very frequent concomitant of strabismic vision, and in this respect the defect bears a resemblance to, if it is not identical with, some of the forms of impaired vision which were described by the late Mr. James J. Adams under the name of muscular amaurosis. I say some of the forms, because a careful perusal of his cases has convinced me that, under that term, different affections have been described.

The two following, however, are good examples of this form of impaired vision, but in different stages.

CASE 50.—Susan M—, æt. 16, a healthy looking girl, fair hair, and gray irides.

Position and appearances of both eyes perfectly natural.

Sight in the left eye perfectly good, if used by itself. By the right eye, alone, cannot see to read newspaper print. After two or three minutes' exertion of the eye over large print or small objects its sight becomes very dim, but least so towards its external canthus.

With both eyes open, can read small print or see to do fine needlework for about twenty minutes, then the object looked at will become dim and confused, so that a rest of the eyes will be necessary, which, if she continues her occupation, will require frequent repetition, the intervals of occupation becoming successively shorter, till the object can be viewed only for a few seconds without appearing misty.

Suffers from severe pain in the brows, more particularly over the right eye, the pains frequently extend to the back of the head, and are increased or excited by bodily exertion or exposure to the rays of the sun.

Sight is much worse in the mornings and evenings. When candles are present, the sight becomes very dim and sparks are seen towards the right external canthus.

*History.*—Three weeks since she caught cold,



which affected the eyes; they were slightly reddened, and the lids adhered together after sleep. In a few days these symptoms subsided, leaving a pain and uneasiness about the left eye. The patient states that, three days since, she closed first one eye, then the other, and then found that the sight was very much worse in the left than the right: at present, this is reversed, the right eye being the defective one as regards the sight.

CASE 51.—Mr. Robert C—, æt. 38, a very intelligent man (by occupation a clerk); has a wife and five children. He is tall, thin, of pale complexion, and unhealthy appearance.

Position of both eyes perfectly straight; their appearance nearly healthy; both pupils being a little more dilated than is usually natural, the right particularly; the colour of the pupils somewhat slaty, as seen when the humours are called slightly turbid.

I requested him to read, and I then found that the right eye, after it had been directed towards the print for two or three minutes, turned slightly inwards towards the nose, and that, if



he continued to read, its inversion became increased.

Sight, with both eyes open, good for a short time, but soon becomes dim and confused. If he endeavours to pursue his occupation, namely, that of writing, after the misty state of vision has once commenced, he will only be able to do so by the aid of repeated intervals of rest, which will require to be lengthened on each repetition, while the periods of occupation will become gradually more and more shortened; so that after one or two hours of irregular work, he will be compelled to rest his eyes for many hours.

The sight, in the right eye, is so very dim that he cannot see to guide himself about if the left be closed.

In the left eye, the sight is so much impaired that he cannot see to read a moderate-sized print for more than a few minutes at a time, without the appearance of a large bright yellow spot being presented to its view, which, on the closing of the eyelids, in the act of winking, would appear as a red flash of fire; *muscæ* are also seen after exertion.

The history of his case is exceedingly curious.

Fifteen years since his occupation required him to sit and write, during many hours of the day, at a desk which had a strong light upon it coming in from a window, situated to his right side; at this time, he observed that his left eye became dim, but was unattended by pain or uneasiness; he continued daily for two years to sit at the same desk in the same position: the light coming strongly on the right side, while the left was in the shade.

He now reversed the position of his desk, so that the light was made to fall on the left side, the right being in the shade, the result of which was, that the sight in the left eye began slowly to improve, while the sight in the right began to grow dim; he continued at this desk, as last placed, for about two years, when the sight in the right had become nearly as much impaired as at present, and the vision in the left had regained its natural appearance. The next desk, at which he sat daily for five years, was situated in such a manner, with respect to a window, that the light came directly towards both eyes.

His sight continued bad in the right, and remained good for a few years in the left, then

*musæ* began to float before it, which would increase if he subjected his eye to extra exertion, or became out of health; the *musæ*, from their first appearance till the present, have never entirely left him.

Two years since, while reading a newspaper in a strong light, a large bright fixed spot, like a scarlet dahlia, suddenly appeared in front of the left eye, and prevented his seeing any minute objects or continuing to read.

One week after the appearance of the bright spot, which continued to be present, he applied to a skilful ophthalmic surgeon, who prescribed preparations of iron, alteratives, purgatives, and counter-irritants. This treatment, with slight variation, was continued during a period of eight months. He then, at a subsequent period, took bark and soda during four months—the result of which was, that the spot became less bright, more distant, and of a yellowish colour, but still attended by red flashes of light at the moment of closing the eyelids. During the last year and a half these appearances have continued of the same character, only very much increasing at times, when out of health, or while endeavouring

to look intently at an object : so that he has required, from time to time, medical treatment for the mitigation of these symptoms.

The patient, having no useful vision in the right eye, and the sight of the left being much impaired, felt fearful of losing all sight, and of thus being disabled from supporting his wife and family ; in this lamentable condition he presented himself to me, and sought my advice. I then submitted the full particulars of the case to a careful and deliberate consideration, which terminated in my proposing to him to allow me to divide the internal rectus muscle of his right eye : at the same time explaining to him the nature of my doubts as to the perfect success of an operation, as well as the probabilities it afforded of relieving him ; and stating, frankly, my want of the knowledge of the result of any similar case to guide my opinion. The conviction of his otherwise hopeless condition being grounded on the fact, that he had consulted the best medical advice during several years without permanent relief, made him readily consent to submit to the operation I proposed, and, in some measure, to share with me its responsibility. I, therefore, on

August 15th, divided the right internal rectus muscle, which had no other effect on the position of the eye, at the time, than to deprive it of the power of turning inwards, to the same extent as it did previously to operation.

16th.—All fog or mistiness from before the right eye had disappeared, and every object looks bright and dazzling.

20th.—Looks very ill ; complains very much of the dazzling appearance before the right eye, and says that the yellow spot before the left eye appears nearer than it had recently been ; and that the flashes of red light are more frequent and vivid. Bowels confined. Ordered a dose of castor oil immediately ; and to take of Hydr. cum Cretâ, gr. iv, with Extr. Conii, gr. v, twice in the day (in pills), and to have enough for six doses only.

23d.—The whole appearance of the man wonderfully improved ; the dazzling before the right eye much less ; bright spot more distant ; flashes less vivid, and not so frequent ; ordered to take only three more pills, one each night, then to omit them.

September 6th.—Since I last saw him has been in the country during eight days, and in

London during the last six. He appears very much improved in health, and all signs of the operation have subsided. He states that, on the *day* following the operation, he saw better by the right eye than he had seen at any one time during the last *seven* years; the dazzling continued during four days; and, as it subsided, every object, viewed by the right eye, became more and more distinct: also, that, on the fourth day of his visit in the country, the bright yellow spot before the left eye suddenly disappeared, and, with it, its red flashes; but, that after he had returned to London, he observed, on the fifth day (yesterday), a slight return of the bright spot and flashes, which lasted for about one minute, and then left him again quite free. To-day he has seen them at times very faintly, and at a distance so remote that they have not interfered with his sight.

With the right eye, unaided by the left, can read a passage in a Bible of rather small type.

12th.—Presented this patient, at St. Thomas's Hospital, to Mr. J. H. Green and Mr. Bransby Cooper, for their examination; he told the time of one of their watches by the right eye, the left being closed.

November 1st.—The general appearance of the man is very considerably improved: in fact, he looks much better and happier than I have ever seen him. Has had no return of the bright spot before the left eye, or one bad symptom in it since the last report. With the right eye, alone, can now see to read distinctly, and without fatigue, a moderate-sized print. With both eyes open can read, write, or view minute objects for many hours without the slightest inconvenience, and is, therefore, capable of supporting his wife and children by the earnings of his occupation as clerk.

Have not seen or heard from him since November.

In reference to the treatment generally of cases such as these, if it can be satisfactorily made out that the imperfection of vision is wholly or even in part due to a shortening or hypertrophy of one of the recti muscles, it would be waste of time and means to adopt any other mode of treatment than their division, and the best means of doing this have been already described in the chapter on the Treatment of Strabismus.



## SECTION III.

ON ASTHENOPIA.

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THE terms impaired vision, intermittent vision, weakness of sight, asthenopia, have been applied to a defect of sight which is characterised by an inability to keep up any sustained effort of vision. "The power of vision," observes Lawrence, "is not impaired; the minutest objects are seen clearly as in the natural state of the eye. But when it has been exerted for some time, the organ becomes tired; objects appear dull, confused, or distorted, and can no longer be recognised; a sense of weariness comes on in the part, occasionally with redness and lachrymal suffusion. The eyelid drops, and a painful pressure is felt in the brow. The uneasiness goes off by rest, the powers of the retina are restored, and the eye may be employed again; but if exertion be imprudently pursued the organ becomes sooner tired. The time in



which this occurs varies, in different instances, from an hour and a half or two hours, to a few minutes. I have seen many instances in which the patient could not read more than five minutes at a time. No pain is experienced in passive vision, or in looking at distant objects out of doors; nor is even strong light offensive." The kind of impaired vision which is here described, is met with either as an idiopathic affection, or as an accompaniment of certain other abnormal conditions of the organ of sight, as was seen in the last section. In the idiopathic variety, by which I mean that which occurs in eyes otherwise perfectly healthy, the defect is frequently connected with a want of tone of the system generally, and of the muscular apparatus of adjustment in particular; so that many persons suffer from this defect whenever they get a little below par. I have seen it follow exhaustion from over-fatigue, from sexual abuse, from hæmorrhage, and from lactation; but the persons who most frequently suffer from it, are those who employ their eyes long together on small objects and by artificial light, and often in ill-ventilated apartments, as tailors and sempstresses. "In many

instanees," observes Maekenzie, "asthenopia results entirely from over-exertion of the sight. Young lads engaged as clerks or bookkeepers, or bound apprentices as tailors, watchmakers, pattern-drawers, compositors, or engravers, and young women employed as dressmakers or sempstresses, afford frequent examples of asthenopia from pure abuse of the eyes. Students, and those engaged in literary pursuits, who spend their days and great part of their nights in reading and writing, often reduce their sight to a state in which it is incapable of supporting the smallest application." This idiopathic form of the affection, may, I believe, generally be cured by abstinence from or removal of the causes which have produced it; by tonic medicines, especially quinine and iron; by exercise in the open air; and by everything which is calculated to invigorate the system and improve the health generally. Unfortunately, the adoption of these means is not always possible, especially by those whose subsistence depends on the constant exertion of the eyes. Under these circumstances, convex glasses of low power are our only resource, and these usually afford relief; but they

should not be used except when absolutely necessary.

The asthenopia which occurs in connection with other defects of the organ of vision, as myopia, presbyopia, muscular amblyopia, &c., will, I believe, generally be found to be the result of these conditions, and therefore amenable to the same treatment as corrects them, and as we have seen that the last-named defect is caused by a shortening or hypertrophy of one of the recti muscles, division of these will cure both the amblyopia and asthenopia. One must cease, therefore, to be surprised at the success of Adams, Phillips, Petrequin, Guérin, and others, who cured asthenopia by dividing some of the ocular muscles. The error into which I conceive these surgeons have fallen, is in supposing that all forms of this affection are due to the same cause, and can be cured by a like remedy. In the second section of this chapter, I gave some examples of the form of impaired vision here alluded to, and which appeared to be unequivocally due to a morbid condition of one of the recti muscles. The two following cases, though they illustrate well this combined defect

of vision, presented no other symptoms which indicated a muscular origin. Still, one cannot fail to recognise in these cases, the same peculiarities by which strabismic vision is distinguished, and it is therefore open to conjecture how far these peculiarities may be the result of some abnormal action of the muscles of the eyeball.

CASE 52.—Miss K—, æt. 19, has imperfect vision of both eyes, but she sees best with the right. To the left eye everything appears in a mist, and only large print can be read with it. A convex glass improves the vision. The right is affected in a less degree, but the character of the imperfection is the same as that of the other. She cannot distinguish persons across the street with either eye, nor can she read a small type. The eyes look perfectly healthy, and the pupils act well. This condition of vision the lady finds a great disadvantage, as she is fond of study; but the effort in using the eyes is so great, that long continuance in reading or working brings on headache, and the sight at the same time becomes so dim

that she is obliged to desist. I recommended convex glasses as the only remedy, and she has continued to use them with great benefit ever since.

CASE 53.—W. H—, æt. 57, a hearty-looking and intelligent man, applied at the South London Ophthalmic Hospital on the 20th of November, 1857, complaining of dimness of vision generally, which was increased when the eyes were used actively. When at work as an iron-moulder, his eyes after a time begin to water, and his sight becomes so dim that he is obliged to leave off for a while. He can read ordinary-sized print when held in a good light, but not small print, and it is seen best at a distance of about six inches. He cannot distinguish distant objects, or even a person across the street; and my colleague, Mr. Zachariah Lawrence, who first saw him, imagined he was myopic till concave glasses were placed before his eyes, when his vision was still further impaired; but on changing them for convex ones he saw well. He states that he has never had good sight, though he was neither near-sighted nor

far-sighted; but the last two years his sight has been getting worse. The movements of the eyes are perfect, and there are no marks of previous disease visible.

I have already remarked that the condition of vision here illustrated, is one that has neither been recognised nor described in any of our standard works of ophthalmic disease; yet allusion is made to it in a little work by my friend, Mr. Alfred Smce, in the following terms: "In many instances, cases occur of defective or diminished vision in which the ordinary visual angle was insufficient to excite the eye, so that it required to be enlarged for that purpose. I meet with such instances constantly in young people, who evidently are unable to see objects of the ordinary visible magnitude, but require the assistance of convex glasses to enlarge the visual angle. When patients are affected with this malady, they cannot see the objects which are visible to ordinary mortals; they cannot read very small type at any distance or by any light; and the best mode of testing their condition is to try the power of sight with

very small type. This condition is also to be met with in old people occasionally; and in these cases we observe that they are neither short-sighted nor long-sighted, nor is there any defect in the power of adjustment. They simply require the object to be magnified, to render it perfectly distinct."

The only remedy which I have tried in these cases is convex glasses of as low a power as the patient can conveniently see with. Mr. Smee, however, after a graphic and amusing account of the annoyance which these cases used to occasion him, proceeds to recommend an instrument which he has invented, and which he calls the amplifier, as well adapted to enable the party to see with facility. This instrument is, in fact, nothing more than a small telescope or opera-glass, and, however well it may enable the patient to see, its size, and its requiring the use of a hand to hold it before the eye, are inconveniences which will prevent its superseding the employment of spectacles or eye-glasses.



## SECTION IV.

ON DIPLOPIA, OR DOUBLE VISION.

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THE conditions which determine the phenomenon of double vision are so well understood that little need here be said on the subject: they may be briefly stated in the following words. For single vision with both eyes, the position and movements of these organs must be normal, so as to ensure their axes being simultaneously directed to the object gazed at: if these conditions be not fulfilled, double vision generally results. I say generally results, because individuals are met with, whose eyes do not move harmoniously, yet who do not suffer, and never remember to have suffered, from this defect of vision; such is the case with, the majority of squinters. But though abnormal position and movements of the eyes may take



place without diplopia, the latter rarely, if ever, occurs without the former;\* nevertheless, the deviation from the normal position may be so slight as to escape observation: indeed, as a general rule, this symptom will be found to occur more frequently in slight distortions than in those which are more marked, and more frequently when the eyes are slightly divergent, than when they are convergent; hence its occurrence as a temporary defect in intoxication, in incipient amaurosis, and still more frequently in paralysis of the motor oculi nerve. The position of the images depends on the direction of the displacement of the affected eye; if this be inwards or outwards, the object seen with that eye will be placed at the side of that which is seen in its proper position by the unaffected eye, and its distance from it will depend on the degree of the distortion and the distance of the object from the eye; if slight, the images will be near together; if more considerable, they will be further apart, and where the inversion or eversion of the eye is great, they will be so

\* This statement of course has reference to binocular diplopia, and not to that rare affection unioocular diplopia.

far apart that the wrong one becomes placed altogether beyond the field of vision of the good eye, and from its being formed on a part of the retina remote from the most sensitive part of that membrane, it makes but a feeble impression, and ceases to be taken cognizance of by the sensorium; for this reason, squinters seldom experience this symptom.

If the displacement of the eye, instead of being lateral, should be upwards or downwards, the two images will be placed one above the other, and should the displacement be around an imaginary axis, passing directly backwards through the centre of the cornea to the posterior part of the eyeball, they would cross each other.

The varieties of diplopia just enumerated, are occasionally met with alone; but more frequently one or more of these forms are combined, and perhaps the most frequent of these combinations is the first with the third, which is what occurs in paralysis of the third nerve. It is perhaps scarcely necessary to observe, that the displacements of the eye which give rise to the first two forms of diplopia spoken of, are produced by one

of the recti muscles, and the displacements which occasion the last form, by one of the obliqui; it is at once evident, therefore, why in paralysis of the third nerve there should be a combination of lateral with oblique diplopia; the eyeball being acted upon by the two muscles which are not paralysed, because they receive their nervous supply from a different source, viz., from the fourth and sixth nerves.

These remarks, I trust, will give a key to the interpretation of the different varieties of double vision, and the phenomena which were observed in Cases 30 and 34 are now intelligible. As respects the treatment of diplopia, it resolves itself into a removal of the cause to which the symptom is owing; if this cannot be attained by medicine, the malposition of the eye, on which the diplopia depends, may be rectified by a simple surgical operation; and in those cases in which the malposition is so slight as not<sup>v</sup> to justify such a proceeding, it is satisfactory to know that the symptom after a time generally disappears, and all objects are again seen single. Should

this symptom, however, persist, two other remedies suggest themselves, one the closing of the lids of the affected eye, the other the employment of prismatic spectacles.